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Report to Congress:

PROPOSED METHOD OF INCORPORATING HEALTH STATUS RISK ADJUSTORS INTO MEDICARE+CHOICE PAYMENTS

Prepared by the Health Care Financing Administration,
Office of Strategic Planning,
Research and Evaluation Group, Division of Payment Research

REPORT TO CONGRESS: PROPOSED METHOD OF INCORPORATING HEALTH STATUS RISK ADJUSTORS INTO MEDICARE+CHOICE PAYMENTS

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EXECUTIVE SUMMARY

Under Section 1853(a)(3) of the Social Security Act as enacted by Section 4001 of Subtitle A of the Balanced Budget Act (BBA) of 1997, the Secretary of the Department of Health and Human Services must "implement a risk adjustment methodology that accounts for variations in per capita costs based on health status and other demographic factors for payment [to Medicare+Choice plans] starting no later than January 1, 2000." The Secretary must develop a method of risk adjustment, submit a report of that method, and have that method evaluated by an "outside independent actuary of the actuarial soundness of the proposal." In response to this BBA mandate, this document outlines the Health Care Financing Administration's (HCFA) risk adjustment methodology, describes the integration of risk adjustment into the Medicare+Choice payment system, and presents estimated aggregate impacts resulting from this change.

Medicare Managed Care Payments prior to the BBA

Since the inception of the Medicare managed care program, capitated payments to plans have been set using an Adjusted Average Per Capita Cost (AAPCC) methodology. The logic of this approach was to base capitated payments on average costs found in fee for service. Because it was assumed that expenditures for enrollees in managed care would be lower, the Medicare estimated fee-for-service costs are discounted by 5 percent. In order to account for local differences in the health needs of beneficiaries, and related differences in spending, these average costs are estimated at the county level, and standardized according to the average demographics observed for beneficiaries in that county. Thus, the basic components of the AAPCC include average fee-for-service costs in the county and an average county demographic factor score. These county AAPCC figures have been expressed in an annual county rate book, which is the basis for all managed care payments for Medicare enrollees.

While the county rate book is the basis for payments, final Medicare capitated payments are also risk adjusted according to the actual demographic profile of each enrollee. The demographic factors used as part of the county rate book calculation were the same factors used to adjust final payment amounts for the demographic characteristics of individual enrollees: age, sex, institutional status, and eligibility for Medicaid. This payment methodology can be best summarized by this (simplified) formula:

Payment = (0.95) x(County Per Capita Costs/Avg. County Demographic Score)x Enrollee Demographic Score

It is the 1997 version of this AAPCC county rate book that is, by law, the basis of Medicare capitated payments under BBA.

Concerns over the use of demographic-only payment adjustors arose from mounting evidence of selection bias, which occurs when healthier-than-average enrollees are attracted to plans. If payments are not adjusted for the health status of managed care enrollees relative to those remaining in FFS, plans can be over (or under) paid. Thus, a major goal of this BBA

mandate is to pay Medicare HMOs based on better estimates of health care costs of the population they enroll (relative to fee-for-service), thereby addressing biased selection in Medicare's risk program. The focus of the proposed method is to replace the demographic adjustors with risk adjusters based on enrollees' estimated relative health status.

Background on Risk Adjustment

The notion of improved health status risk adjustors surfaced in the early 1980's, when models using prior Medicare claims expenditures were investigated. By adding diagnostic information to demographic-only adjustors, the predictability of the risk adjustment models was greatly improved. By the late 1980's, the "Diagnostic Cost Groups" (DCGs) model was developed using demographic and inpatient hospitalization data to predict enrollee expenditures. In the early 1990's, risk adjustment research took the next logical step of combining ambulatory and physician usage data with in-patient service use information to generate comprehensive models. HCFA funded the development of a number of risk adjustment models as potential options for use within a payment system, including the Principal In-Patient Diagnostic Cost Group (PIP-DCG) and the Hierarchical Coexisting Conditions (HCC) models (developed by a consortium or researchers at Boston University, Health Economics Research and Harvard University School of Medicine) and Ambulatory Clinical Group (ACGs) systems (developed by Johns Hopkins University and the Lewin Group).

Selection of the PIP-DCG Model

A prospective PIP-DCG model was chosen to fulfill the mandate for risk adjustment implementation on January 1, 2000 based on two criteria: 1) model performance, and 2) data availability. Based on previous research, the maximum explained variation that a prospective risk adjustment model is likely to achieve for an individual is between 20 and 25 percent, with the remainder attributed to random or unforeseeable events (such as expenditures related to accidents). The PIP-DCG model explains about 6 percent of individual variation, while the more complex comprehensive models (such as the HCCs and ACGs) explain about 9 percent. Currently used demographic-only adjusters explain only about 1 percent of the variation in health spending among individuals. Even the PIP-DCG model, therefore, offers a substantial improvement in model performance over the current demographic-only adjustments. However, in an insurance application, a more relevant measure is how well the model performs for groups.

This concept can be assessed using a "predictive ratio," i.e., the predicted expenditures divided by actual expenditures for a group. For large, random groups of beneficiaries, all the models have fairly high predictive ratios and predict expenditures fairly well. In a payment system application, however, the risk adjustment must also predict expenditures reasonably accurately for groups that are small and/or with individuals exhibiting high health expenditures, or groups of people with particular diseases (since not all Medicare+Choice plans will have large or completely randomly distributed enrollment populations). By this standard, the PIP-DCG model exhibits far better predictive ratios than the AAPCC method for non-random groups. More comprehensive

and sophisticated HCC and ACG models would improve these ratios even further.

The second selection criteria considered in choosing a risk adjustment model for application in the Medicare+Choice payment system relates to the available data. The BBA mandated the collection of inpatient encounter data. Medicare+Choice plans submitted data for the "start-up" year of this data mandate (discharges from July 1997 to June 1998) through the late fall of 1998. Given the current availability on only inpatient encounter data, the only feasible risk adjustment approach for implementation by 2000 is the PIP-DCG model, which can be implemented using inpatient diagnostic information combined with administratively available demographic information. The primary strength of an inpatient only diagnoses model is the availability of reliable data, which is familiar to providers as a result of hospitals coding and collecting such data since the mid-1980s.

There are concerns that implementation of an inpatient-data driven risk adjustor may create an incentive to increase hospitalization and is not as robust in predicting costs as a comprehensive mode. To a certain extent, inappropriate incentives can be mitigated by filtering out short stays or diagnoses that are clinically vague, non-predictive of future expenditure, and/or only infrequently treated in in-patient settings. Given the limitations of an inpatient-only risk adjustment approach, the implementation of the PIP-DCG model should be construed as an interim step in the development of risk adjusted Medicare+Choice payments. As the collection of full encounter data (i.e. diagnoses collected for all sites of service) becomes feasible, HCFA proposes to replace the PIP-DCG methodology with a comprehensive risk adjustment model.

The PIPDCG Model

Briefly, under the PIP-DCG model, individuals are assigned to a single PIP-DCG group based on the principal inpatient diagnosis they experienced that has the greatest future cost implications. The model also uses age, sex, original reason for Medicare entitlement (disability) and entitlement to state payments for Medicaid, to derive a predicted payment. This predicted payment is then converted to beneficiary relative risk factors by dividing individuals' predicted expenditures by the national mean. The model is also prospectively based; in other words, base year inpatient diagnoses are used in the model to predict payment year health expenditures. Because this model was developed and calibrated using a year of inpatient diagnoses, a full year of data is essential for assigning beneficiary risk factors. For implementation in January 2000, HCFA will use a "time shifted" approach, where diagnostic information from July 1998 through June 1999 will be used to assigned risk factors that take effect January 1, 2000; the data collection year has been "shifted" back by 6 months to allow final payment factors to be assigned to beneficiaries at the start of the payment year.

Model Development and Description: In the PIP-DCG risk adjustment system, hospitalizations are used as markers for a particularly ill and high cost subset of beneficiaries for whom higher payments will be made in the next year. However, incremental costs associated with beneficiaries who have been hospitalized for conditions used in the PIP-DCG system are no

longer in the base payment category. Payments for people in the base payment category decrease as payments are increased for beneficiaries identified as high cost. Because an inpatient hospital-based system depends on data from just one site of service, only a subset of conditions are recognized for increased payments. That is, the system should recognize admissions for which inpatient care is most frequently appropriate and which are predictive of higher future costs. For example, admissions for diseases most commonly treated on an outpatient basis should remain in the base group and should not be used for upwards adjustment, since inclusion of these admissions would provide an inappropriate incentive for hospitalization.

The PIP-DCG model was estimated using diagnostic information for Medicare FFS enrollees from inpatient hospital stays during calendar year 1995, and Medicare costs in the following year. The sample used in the estimation analyses consisted of individuals included in the 5-percent sample of Medicare beneficiaries who were alive and enrolled in Medicare during all of 1995, and on January 1, 1996. Beneficiaries with certain characteristics, for example, HMO enrollees, end-stage renal disease enrollees, and new Medicare eligibles in 1996, were excluded from the analyses. In general, these exclusions were made to increase confidence that a complete set of Medicare claims for each beneficiary in the sample data set was included in the model development. The final estimation data set included approximately 1.4 million Medicare beneficiaries.

While the PIP-DCG model uses only inpatient diagnoses in creating the risk adjustment classification system, the model *predicts total expected costs* for the following year across multiple sites of services. Consequently, all Medicare expenditures, other than those for hospice care, were included in the calculation. Medicare expenditures for hospice care were not included because Medicare+Choice organizations are not responsible for hospice care. The model was estimated assuming no time lag between the base year (diagnostic information) and the predicted expenditures; that is, calendar year 1995 beneficiary diagnoses were used to predict calendar year 1996 expenditures.

Diagnostic classification: The risk adjustment model estimation process begins with a classification system, forming the inherent logic of the model. For the PIP-DCG model, principal inpatient diagnoses are classified into diagnosis groups (DxGroups). The DxGroups comprise an exhaustive classification of all valid International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic codes. The primary criteria in forming the DxGroups were clinical coherence and an adequate sample size to estimate average expenditures. Beneficiaries with multiple different inpatient diagnoses could have multiple hospital stays, and would potentially be assigned multiple DxGroups.

Creation of PIP-DCG groups: Next, DxGroups were aggregated into payment groups, or PIP-DCGs, using a sorting algorithm that ranked DxGroups based on 1996 actual expenditures. Highest expenditure DxGroups were grouped into the "highest" PIP-DCG. Once beneficiaries with the highest costs were placed into a DxGroup, those beneficiaries and all their associated expenditures were removed from the data for other DxGroups and then the DxGroups were re-

ranked. The DxGroups with the next most costly diagnoses were grouped into the next highest numbered PIP-DCG, and those beneficiaries were removed from the remaining DxGroups. The process was repeated until each beneficiary and his or her expenditures were assigned to a single PIP-DCG group. Beneficiaries with multiple inpatient diagnoses were placed in their highest expenditure PIP-DCG group. In this way, each PIP-DCG group was defined according to average total expenditures for beneficiaries with inpatient diagnoses, which were first categorized, grouped, and sorted using the DxGroups. Based upon this sorting algorithm, more than 20 initial PIP-DCGs were defined. Lower average expenditure PIP-DCG groups had lower cost ranges (or intervals), while the highest average expenditure PIP-DCG groups had wider ranges.[1]

Modifications to the PIP-DCG Model: After the initial sorting of DxGroups into PIP-DCG groups was complete, a clinical panel reviewed the placement of the DxGroups and their resulting predicted expenditures, to determine the appropriateness of their application in a payment model. Through this process, 75 DxGroups (covering about 1/3 of the admissions) were identified as: (1) representing only a minor or transitory disease or disorder, not clinically likely to result in significant future medical costs, (2) rarely the main cause of an inpatient stay, or (3) vague or ambiguous. These groups, as recommended by the clinical panel, were identified as those most likely to result in inconsistent or inappropriate reimbursements and were placed (with their associated expenditures) in the base payment category (for which the payment is a function of demographic factors). Examples of these groups include the DxGroup for fluid/electrolyte disorders and malnutrition. Though the treatment for individuals with this diagnoses is often quite costly in the following year, the diagnosis is clinically vague and, therefore, represented a likely target for coding "creep." The clinical panel concluded that many of the sickest individuals with this diagnosis were likely to have another more specific hospitalization that would trigger appropriate increased reimbursements. Then, the remaining DxGroups were resorted and placed into revised DCGs for the payment model. A total of 15 PIP-DCGs (above the base payment category) are included in the final payment model. Costs for persons with excluded admissions, as well as no admissions, are included in the demographically-based payment amounts, as they are under the current Adjusted Average Per Capita Cost (AAPCC) system.

As a second strategy to ensure consistent and appropriate payment levels, beneficiary diagnoses reported as a result of a short hospital stay (1 day or less) were left in the base payment category. Since the majority of 1-day stays are for diagnoses already assigned to the base group, the effect on payment is small. Also, short stays are often indicative of less serious, and, hence, less costly cases. It is important to note that these modifications do not mean that these expenditures have been excluded from the model. Rather, the payments associated with these

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[1] The PIP-DCG groupings were further refined using a number of criteria. First, each original PIP-DCG group retained its identity in the final payment model only if it contained at least 1,000 beneficiaries in the original sample; this minimum sample size was defined to assure stability of estimated payments in the model. If sample sizes were smaller than 1,000, the potential PIP-DCG was expanded to include DxGroups with average expenditures in the next lower range until the sample size was satisfied. If at any time during the sorting algorithm a DxGroup had fewer than 50 beneficiaries assigned to it, it was assigned to the base payment category. This base payment category also included all beneficiaries (and expenditures) for whom there was no Inpatient diagnosis during 1995.

diseases are captured in increased payments for the base payment category.

HCFA received a number of comments (based on the September 8, 1998 Federal Register notice) regarding this decision to "exclude" 1 day stays from the final PIP-DCG groups. Related comments expressed managed care industry concern that a risk adjustment model based only on inpatient diagnoses, particularly one which further excludes short stays, would disadvantage some plans and not provide "credit" for management on an outpatient basis. In response, we must stress that the purpose of the PIP-DCG model is to serve as an interim step towards implementation of a comprehensive risk adjustment model (i.e., one which uses diagnoses from all sites of service). The current AAPCC model makes no adjustments for level of illness, chronic or otherwise. The goal of the PIP-DCG model is to offer a significant improvement over the current system by identifying a relatively small group of high cost, serious illnesses, and provide a marginal additional payment appropriate for these seriously ill beneficiaries. Another rationale for the exclusion of one day stays was to limit possible "gaming" of the new payment system. Plans that might convert treatment of some diseases from outpatient to one day admissions, increase the frequency of short "observational" stays, and otherwise increase the use of short hospital admissions for marginal diagnoses, would trigger potentially large increases in payments for relatively low cost (the costs associated with a one day hospital stay). To further refine the model as a method of identifying the sickest individuals, and to discourage the potential payoff for gaming, we excluded one day stays of any diagnoses for the purpose of triggering increase PIP-DCG payments.

Under the final payment PIP-DCG model, beneficiaries who are hospitalized for chemotherapy (ICD-9 codes V58.1 and V66.2) are treated as exceptions. These codes are indicators of a treatment method, rather than a particular disease. Recognizing, however, that Medicare's current inpatient coding rules require that the diagnoses for beneficiaries who are hospitalized for chemotherapy must be coded using these V-codes as the principal diagnoses, the most appropriate PIP-DCG group for these beneficiaries would be assigned based on the type of cancer, using a secondary diagnosis. In addition, the final payment model also treats individuals diagnosed with AIDS as an exception. In this case, individuals with a secondary diagnosis of AIDS will be placed in the same PIP-DCG group as individuals with a reported principal diagnosis of AIDS. The rationale for this decision is HCFA's analysis showed that individuals with a secondary diagnosis of AIDS tended to have expenditures close to those admitted explicitly for the treatment of AIDS.

Addition of Demographic and Other Factors: Twenty-four age/sex cells were included that mirror the splits currently used in Medicare's current demographic adjustment methodology For the purposes of calibrating the model, beneficiaries are assigned to more than one age cell if they aged into a new cell during 1996. For example, a beneficiary aged 69 on January 1, 1996 but who turned 70 years old later in 1996, is assigned to both the 65-69 and the 70-74 age cells as a fraction of eligible months in each cell. The value of the age/sex variable is the fraction of 12 months the person is in that cell. Payments for all months are thus set to the weighted average of the two payments and no change is necessary in the birthday month.

In the development of the final payment model, HCFA considered the inclusion of other demographic variables. The purpose of including other demographic independent variables was to take into consideration the unique cost implications of characteristics not related to admissions, and to increase the accuracy of the payment estimates for subgroups of the Medicare population. The additional independent variables considered for inclusion were:

- Originally disabled;
- Medicaid status;
- Institutional status; and
- Working aged.

Originally disabled: A beneficiary is defined as originally disabled if he is currently entitled to Medicare as an aged beneficiary, but was originally entitled by reason of disability. The other variables are currently used in Medicare's demographic adjustment methodology, although not necessarily in the way proposed here. Preliminary analyses showed that Medicare expenditures for beneficiaries who were originally disabled or Medicaid enrolled were substantially higher than predicted by age, sex, and principal hospital diagnoses. Data on these characteristics for beneficiaries are available in HCFA administrative files. Analyses showed that if these factors were not taken into consideration in the calibration, the model would not predict the average expenditures of several important, and higher-cost, Medicare subgroups. In the payment model, the originally-disabled variable is added interactively with the age/sex cell variable. This means that for a given age/sex cell, predicted costs vary between those who were originally disabled and those who were not originally disabled. Alternatively, it allows for the possibility that the trajectory of expected costs as beneficiaries age could differ between the originally disabled and those not originally disabled.

Medicaid eligibility: Currently, Medicaid status is a concurrent adjustment factor for Medicare capitation payments. That is, a Medicare beneficiary is placed into an AAPCC "rate cell" payment category each month based on his or her current Medicaid enrollment status. For the purposes of risk adjustment, we defined Medicaid status as enrollment in Medicaid in any single month during the diagnosis year (e.g., all or part of 1995). Thus, in the risk adjustment system, beneficiaries who are Medicaid-eligible at any time during the data collection year will be eligible for the Medicaid payment increment for the entire payment year; payments will no longer vary according to month-to-month Medicaid eligibility in the payment year. This variable is also included interactively with the age/sex cell variable.

Institutional status: Another independent variable considered for inclusion was institutional status. Institutional status is currently used in the AAPCC methodology as a concurrent risk adjuster. For each prior month in a certified institution, a beneficiary is paid at the higher institution rate cell amount the following month. It is included as a marker for higher expected concurrent cost. HCFA's analysis using Medicare Current Beneficiary Survey (MCBS) data showed that the PIP-DCG model accurately predicts the average costs of the entire group of institutionalized beneficiaries. This suggests that there is no need for an institutional factor.

However, our analysis also showed that mean actual Medicare payments for those in post-acute care facilities are far greater than those for long-term care facilities. In Medicare, a SNF stay requires a preceding hospital stay. The payment system is designed to pay premiums that are correct on the average for groups of enrollees. It does not pay based on actual events in the payment year. If we did so, we would also recoup payments for those who incur very low costs in the payment year. Thus we do not pay more for the particular group that spends some time in a SNF. While those in long term care facilities incur more costs than average Medicare beneficiaries, they incur less costs than predicted by the PIP-DCG model. An institutional factor for this population would actually be negative if implemented. The incentives for identifying the long term institutionalized and reporting on this group are low when the result is a payment reduction. We have therefore decided not to pay based on this site of service. There are relatively few enrollees in this group and the overpayments will be small. Given these considerations, HCFA will not include an institutional status factor in the payment model.

To estimate the final coefficients of the PIP-DCG calibration model, HCFA regressed annualized 1996 expenditures on the 15 PIP-DCGs, age/sex groups, originally disabled status, and Medicaid status. The model is specified so that there is a separate variable for each age/sex group. To this there is an additional vector of age/sex variables for those who were originally disabled, and a vector of age/sex variables for those who were Medicaid enrollees.

Demographic-only factors for new enrollees: As described earlier, the model was calibrated using only beneficiaries for whom Medicare data existed in 1995 and 1996. One implication of this model is that it requires diagnoses in the year before payment is made. Therefore, the model cannot predict expenditures for beneficiaries for whom Medicare does not have diagnosis data. The Medicare program cannot compile diagnosis data on beneficiaries for the year before they enter the program. Thus, no prior diagnosis information exists for the new disabled beneficiaries and age-in beneficiaries. Predicted expected cost estimates were derived for these beneficiaries using only demographic factors. Two similar, but different methods were used to predict expenditure estimates for the age-ins in the 65-69 age groups and other new eligibles. Those age 70 and above, and those under 65, were assigned the mean predicted expenditure for beneficiaries in the same age/sex/Medicaid status cell. For the age-ins between age 65 and 69, a different procedure was used because the mean predicted value for the age bracket was based mainly on persons 67-69 years old in 1996. Actual expenditures in 1996 for persons 67-74 years old were computed and used in a regression to predict the missing age groups. For all new enrollees, payments based on Medicaid eligibility will be made retroactively, once enrollment can be established and verified.

Actuarial graduation of the final payment model factors: HCFA's Office of the Actuary revised the age/sex demographic coefficients. Upon review, the age/sex coefficients for the originally disabled, and Medicaid recipients were found to be somewhat irregular in pattern. This pattern, if uncorrected, would have led to irregular changes in payments as beneficiaries in these groups aged. Therefore, these coefficients were refined by HCFA actuaries so that the predicted payment patterns across age groups within each of those categories was smoothed.

The following diagram summarizes the proposed system cells:

		Base Payment: Everyone Receives	**Add Differentials for:**		
			Medicaid Eligibility	**Previously Disabled**	**PIP**
Claims experience	**Age Category**	**By Gender**	If Medicaid eligible in base year	If disabled in base year	If Dx scored in PIPDCG in base year
Less than one year	Under 65	5 cells by gender	5 cells by gender	not applicable	
	Over 65	11 cells by gender	11 cells by gender		
One or more years	Under 65	5 cells by gender	5 cells by gender	not applicable	15 PIP cells
	Over 65	7 cells by gender	7 cells by gender	7 cells by gender	

Working Aged Adjustment: The PIP-DCG model was calibrated using Medicare beneficiaries not covered by employer or other group policies. For beneficiaries with employer insurance, Medicare is the secondary payor and its liability is much smaller than for those who are not working. Using administrative data, it is estimated that, on the average, Medicare's liability for the working-aged is 21 percent of the liability for those for whom Medicare is the primary payer. Therefore, payments made to beneficiaries in this status were reduced to 21 percent of what they would have been.

Assignment of risk factors: After Medicare+Choice organizations submit inpatient hospital encounter data for the payment year, we will use the demographic information and diagnostic information from all Medicare+Choice organizations a beneficiary may have joined and from FFS to determine the appropriate risk factor for each beneficiary. It is at this point that information regarding beneficiary Medicaid eligibility (in any single month during the diagnosis data collection year), original reason for Medicare entitlement (originally disabled) for any one month, identification as a new enrollee, beneficiary age, sex and working-aged status (beneficiary covered under a employer insurance) are determined using Medicare administrative data files, and are used along with inpatient diagnostic data to assign the appropriate risk factor.

When a Medicare+Choice organization forwards beneficiary enrollment information to HCFA, we, in turn, will send the organization the appropriate risk factor for the beneficiary, as well as the resultant payment. Because the risk factor is *computed for each individual beneficiary for a given year,* the factor follows that beneficiary. In addition, since all beneficiaries

will have risk factors, information will be immediately available for payment purposes as beneficiaries move among Medicare+Choice organizations.

Medicare+Choice Risk Adjusted Payment Model

To determine risk adjusted monthly payment amounts for each Medicare+Choice enrollee, individual risk factors (described above) will be multiplied by the appropriate payment rate for the county determined under section 1853 of the Act. To make this calculation appropriately, an adjustment to these rate book amounts will be required before applying the risk adjustment factors discussed above. This adjustment, or rescaling factor, is necessary in order to account for the fact that the existing county rate book is already scaled to the set of demographic factors used under the current system, but not to the risk factors we will be using under the new system. If the PIP-DCG model risk adjustment factors were applied to unadjusted county rate book amounts, this would create inaccurate payments inconsistent with Congress' mandate in section 1853 of the Act.

The application of the rescaling factor in effect translates the rate book amounts into the same language used under the risk adjustment methodology. As a result of rescaling, payment using the risk-based rate book for a person with the average risk factor in a county would be the same as payment for a person with the average demographic factor in that county using the original demographic-based rate book. (However, a person with the average demographic factor does not necessarily have the average risk factor.) To the extent that an organization enrolls sicker people, the organization will receive higher payments. By itself, the rescaling process is payment neutral (which is not the same as budget neutrality). That is, the apparent effects of the rescaling factor on the resulting county rates is exactly offset by the estimated effects of moving from demographic to risk factor standardization in assignment of individual enrollee factors. By itself, rescaling does not raise or lower payments. Whether aggregate payments to a plan increase or decrease depends upon the risk profile of the beneficiaries enrolled in the plan.

Calculation of the Rescaling Factor: The essential purpose of the implementation of risk adjustment is the *substitution* of individual enrollee demographic factors with a new individual enrollee risk adjustment methodology. But this substitution should take place in *two* places: in the standardization of county rates, and in the method of estimating relative risk of individual enrollees. BBA modifications to the rate book make a direct rate book standardization substitution difficult because the 1997 demographic AAPCC rates are the basis for future rate books.

The old (demographically-based) AAPCC rate book represented the cost to Medicare in a given county for the national average beneficiary measured demographically. County rates were calculated by dividing county per capita costs by county average demographic factors. Prior to BBA, these rates were updated annually. However, because of BBA modifications, all Medicare+Choice county rates have their basis in the 1997 AAPCC Rate Book. Thus, the factors used in calculating this 1997 Rate Book are "locked in" – including the average county demographic factors. Also, the 2 percent minimum increase must be based on the prior year's rates. Despite these policy complications, it is important to apply the new enrollee risk adjustment

methods to an appropriately standardized rate book. This is the case because, if we were to shift from an enrollee *demographic* factor to *risk-based* adjustments, while maintaining the factors underlying the current rate book, a critical inconsistency would be created in the overall payment methodology. The risk adjustment methodology adds disease information to purely demographic information. Though attempting to measure the same thing -- relative health status -- the range of factors for the demographic-only and risk factors differs. This is in part simply because the measurement range (or "ruler") of risk factors exceeds that of the old demographic-only factors, and because the new risk factors are able to distinguish differences in health status more accurately. However, because the "rulers" differ between demographic and risk factors, a technical modification is necessary for payments to remain methodologically correct. Without some adjustment, this inconsistency between the standardization factors used in the county rates and the enrollee risk factors will result haphazardly in either significant underpayments or overpayments, depending on the county.

Use of a rescaling factor: The most direct and accurate way to fix this problem would be to calculate both the average county and individual enrollee factors on the same scale – as originally done when both were calculated using demographic factors. Unfortunately, this is not possible since the rate book (including the demographic basis for the average county factor) is set by law. However, a "county rescaling factor," which is part of the risk adjustment methodology, places both the county and enrollee factors back on a comparable scale. The rescaling factor for each county will be defined as the ratio of the following:

$$\text{County Rescaling Factor} = \frac{\text{(Risk County Rate)}}{\text{(Demographic County Rate)}}$$

The denominator of this ratio (the demographic county rate) is simply the county rate calculated under the current system. The numerator (risk county rate) is the county rate properly standardized to the new risk adjustment factors.

Transition Policy

HCFA has decided to include a transition period as a component of our risk adjustment methodology, initially using a blend of payment amounts under the current demographic system and the PIP-DCG risk adjustment methodology. Under a blend, payment amounts for each enrollee would be separately determined using the demographic and risk methodologies (i.e., taking the separate demographic and risk rate books and applying the demographic and risk adjustments, respectively). Those payments amounts would then be blended according to the percentages for the transition year.

HCFA determined that the blend method can provide adequate safeguards against abrupt changes, in particular by providing initially for a low blend percentage of the risk-adjusted payment rate. We have therefore decided that the first year blend percentages will be 90 percent of the demographically adjusted rates, and 10 percent of the risk-adjusted payment rate. We have also decided to implement a five-year transition, which will culminate in full implementation of comprehensive risk adjustment, using all encounter data, in the fifth year. Specifically, we have

decided upon the following transition schedule:

CY 2000	90 percent demographic method	10 percent PIP-DCG method
CY 2001	70 percent demographic method	30 percent PIP-DCG method
CY 2002	45 percent demographic method	55 percent PIP-DCG method
CY 2003	20 percent demographic method	80 percent PIP-DCG method
CY 2004	100 percent comprehensive risk adjustment (using full encounter data)	

In order to implement comprehensive risk adjustment in CY 2004, we will soon be providing plans with guidance concerning requirements for submission of outpatient, physician, and other non-inpatient encounter data.

HCFA's preliminary analyses of the first year's impact of risk adjustment indicate that these blend percentages should significantly reduce the initial impact to organizations of risk adjustment. Specifically, these analyses suggest that the decrease in aggregate payments to M+C organizations under this transition from risk adjustment alone will be less than 1 percent in the first transition year. While the impact on specific organizations will vary, this preliminary analysis also suggests that the maximum decrease in payment to any organization from risk adjustment alone will be less than 2 percent. (These analyses were based on incomplete encounter data available prior to December 1998. Updated analyses, using complete encounter data, will be conducted in early 1999, and these analyses will be provided to organizations on March 1, 1999, for use in determining their Adjusted Community Rate proposals for CY 2000.) We will continue to monitor the impacts on organizations throughout the transition period.

Summary of HCFA's Proposed Approach for 2000

The approach HCFA will use to meet the year 2000 mandate for risk adjusted payments will:

(1) Be based on inpatient data;

(2) Apply individual enrollee risk scores in determining fully capitated payments;

(3) Utilize a prospective PIP-DCG risk adjuster to estimate relative beneficiary risk scores;

(4) Apply separate demographic-only factors to new Medicare enrollees for whom no diagnostic history is available;

(5) Apply a rescaling factor to address inconsistencies between demographic factors in the rate book and new risk adjusters;

(6) Use 6 month old diagnostic data to assign PIP-DCG categories (the "time shift" model, as opposed to using the most recent data and making retroactive adjustments of payment rates part way through the year);

(7) Allow for a reconciliation after the payment year to account for late submissions of encounter data;

(8) Phase-in the effects on risk adjustment, beginning with a blend of 90 percent of the demographically adjusted payment rate, and 10 percent of the risk-adjusted payment rate in the first year (CY 2000); and

(9) Implement processes to collect encounter data on additional services, and move to a full risk adjustment model as soon as is feasible.

Independent Actuarial Review

The BBA mandate, aside from requiring this Report to Congress outlining HCFA's proposed methodology, also required an independent actuarial review of that method. To meet this requirement, HCFA arranged for a panel of experts under the aegis of the American Academy of Actuaries to review and comment on both the risk adjustment model and its application in Medicare+Choice payments. In summary, the Academy found the PIP-DCG based payment method as proposed by HCFA to be actuarially sound; they conclude: "On balance, and with a phase-in, the proposed risk adjustment method appears to be a reasonable step in what should be a long-term evolutionary process." The full text of the Academy Work Group's report is attached as Appendix 4.

CHAPTER 1: PURPOSE AND BACKGROUND

Since 1985, Medicare payments to risk contracting Health Maintenance Organizations (HMOs) for aged and disabled beneficiaries have been based on actuarial estimates of the per capita cost Medicare incurs paying claims on a fee-for-service (FFS) basis in a beneficiary's county of residence. (Medicare's costs in paying claims for beneficiaries with end-stage renal disease are not considered in these county estimates, but are treated separately on a statewide basis.) These county estimates have been adjusted for the demographic composition of that county (age, gender, Medicaid eligibility status, working aged status, and institutional status) in order to produce a figure representing the costs that would be incurred by Medicare on behalf of a national average Medicare beneficiary living in that county. These county per capita payment rates, adjusted for the national average beneficiary, have been published annually as the county rate book. Prior to January 1998, monthly payments to HMOs for each enrollee were based on this county rate book amount, adjusted for the enrollee's demographic factors. This methodology is known as the "Adjusted Average Per Capita Cost" (AAPCC) methodology, and HMOs with Medicare contracts under section 1876 of the Social Security Act (the Act) were paid on this basis between 1985 and 1997.

In enacting the new Part C of Title XVIII to create the Medicare+Choice program, the Congress provided, in a new section 1853 of the Act, for a revised methodology for paying organizations that enter into Medicare+Choice (M+C) contracts. Under this new methodology, the equivalent of the above-described county rate book (that is, the county-wide amount that is adjusted by an individual enrollee's demographic status to determine the final payment amount) is

based on the greatest of three amounts. The first amount is a new blended payment rate methodology that would combine local and national rates in setting county rates. The second amount is a new minimum specified rate amount (for example, $367 per month per enrollee in 1998). The third amount is based on a 2 percent increase over the prior year's rates, with the rate book for 1997 serving as the baseline. As in the case of the AAPCC methodology described above, monthly payments are the county rates under section 1853 of the Act, adjusted for the demographic status of each enrollee.

Under section 1876(k)(3) of the Act, the new Medicare+Choice payment methodology under section 1853 of the Act applies to existing HMO contracts under section 1876 for 1998, and to Medicare+Choice plans beginning in 1999. Section 1853(a)(3) of the Act requires the Secretary to develop and implement a new risk adjustment methodology to be used to adjust the county-wide rates under section 1853 of the Act to reflect the expected relative health status of each enrollee. This new methodology, which must be implemented by January 1, 2000, will replace the current method of adjusting county-wide rates that are based only on the demographic factors of age, gender, Medicaid eligibility, working aged status, and institutional status. The goal is to pay Medicare+Choice organizations based on better estimates of their enrollees' health care utilization relative to the fee-for-service (FFS) population.

While the Medicare+Choice legislation mandates the implementation of risk adjustment in general, the legislation provides the Secretary with broad discretion to develop a risk adjustment methodology that would "account for variations in per capita costs based on health status and

other demographic factors." Related to this mandate, BBA provides the Secretary with additional authorities and reporting requirements. To support risk adjustment, BBA gives the Secretary the authority to collect in-patient encounter data (for admissions occurring on or after July 1997). The Secretary may also require the submission of "full encounter" data (in-patient, outpatient, physician, and other services), for beneficiary services occuring on or after July 1, 1998. These expanded data could be used to implement a more extensive risk adjustment system. The legislation is not specific as to how risk adjustment is to be implemented. Instead, the Secretary was required to submit a Report to Congress outlining the risk adjustment methodology that will be implemented beginning in 2000. That report must be accompanied by an independent actuarial review of the Secretary's proposed methodology.

This document fulfills the reporting mandate, and will outline the Health Care Financing Administration (HCFA's) proposed methodology for implementation of risk adjusted Medicare+Choice payments in January 2000. This report will also provide HCFA's rationale for the proposed methodology, a description of how health status risk adjusters will be applied to the Medicare+Choice rate book, projected impacts of this payment change, and possible future policy directions.

Background: Risk Adjustment and Medicare

The Medicare program has maintained a long-term interest in risk adjusters and risk adjusted payment systems, most of it related specifically to the managed care program. Recent

intense work on the development of improved risk adjustment methodologies was prompted largely by research on selection bias in the Medicare risk program, and the need for a more refined payment method that adjusts for the health status of the beneficiary.

Prior to BBA, Medicare risk payments to managed care plans were based on actuarial estimates of per capita Medicare fee-for-service costs in each county for the aged and disabled groups of beneficiaries. These county payment estimates were adjusted for the demographic composition of the county so they mirrored the cost of a national-average Medicare beneficiary (if this national-average beneficiary were situated in that county.) The demographic factors used to make these adjustments were the relative costs of beneficiaries grouped by age, sex, welfare status and institutional status. The per capita payments (multiplied by .95), and adjusted for the county average demographic factors, have been published annually as the County Rate Book. Actual payments for each enrollee have been the product of the Rate Book amount for the enrollee's county of residence, and the enrollee's individual demographic factor. Implemented in 1985, this payment system was called the "Adjusted Average Per Capita Cost" (AAPCC) methodology. It is the 1997 version of this AAPCC county rate book that is, by law, the basis of Medicare+Choice program.

Many criticisms have been made of the AAPCC payment system, ultimately leading to the reforms mandated under BBA. Some criticisms focused on the county-basis for the payment rate cells. Under the AAPCC system, managed care plans were expected (on average) to be competitive with fee-for-service in each county. Many people believed, however, that the

differences in payment levels across counties were too extreme, that payment levels in many communities were either too low or too high, and that year to year changes in payment levels were too unpredictable. These issues were addressed under BBA through modifications to the county rate book methodology. Beginning in January 1998, Medicare 1997 county rates will form the basis for all future payments. Using the 1997 rates, national and county levels will be blended, a minimum payment level will be set, and year to year changes will be related to a discounted national rate of increase.

Most other concerns about Medicare's managed care payment system related to mounting evidence of selection bias. Since AAPCC capitated payments were based on 95 percent of expected payments for fee-for-service beneficiaries, in theory, the HMO program should have lowered costs for Medicare enrollees by 5 percent. Despite this, evidence for selection bias suggests overpayment by Medicare. Capitated payment provides incentives for plans to minimize medical costs by enrolling the healthiest of Medicare beneficiaries. From the perspective of the beneficiaries, Medicare HMOs may seem more attractive to healthier beneficiaries (who don't anticipate using many medical services, and therefore have fewer provider preferences), and beneficiaries who lack long-standing ties to specific providers and may therefore be willing to consider switching to HMOs. This "selection" by beneficiaries complimented efforts by some plans to enroll the lowest risk Medicare beneficiaries. Selection bias is possible because demographic risk adjusters, intended to adjust for variations in individual enrollees' health expenditures, proved weak in explaining these differences (Lubitz, Beebe, and Riley, 1985; Newhouse, 1986; Ash, et.al. 1989). But in some cases, beneficiaries with greater need for

services might be attracted to HMOs offering little or no monthly premiums, coverage of regular Medicare co-pays and deductibles, and additional benefits not covered under Medicare fee-for-service (FFS) such as outpatient prescription drugs. To address these problems, the BBA mandates implementation of health status risk adjusters as a substitute for demographic factors.

Selection bias: What is the evidence for selection bias in the Medicare risk program? Studies examining relative health status and expenditures of Medicare HMO enrollees versus fee-for-service beneficiaries began even prior to national implementation of the Medicare risk program.[1] Research evaluating Medicare HMO demonstrations, begun in the early 1980's in preparation for the risk program, raised questions about the accuracy of capitated payments that were adjusted using demographic factors only (Eggers and Prihoda, 1982; Lubitz, Beebe, and Riley, 1985). Subsequent evaluations of the national risk program (funded by HCFA and conducted by Mathematica Policy Research (MPR)) found that HMO enrollees had substantially lower reimbursements during the two years prior to enrollment than non-enrollees after adjusting for demographic risk factors used in the AAPCC payments (Hill and Brown, 1990). MPR estimated that due to selection bias, even taking into account the 5 percent discount on the AAPCC already in effect, Medicare payments were an average of 5.7 percent higher than they would have been if the HMO beneficiaries had remained in fee-for-service. Without the 5 percent cut for efficiency, the payments would have been 11.3 percent too high (Brown, et. al., 1993).

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[1] The Medicare risk program, also known as the TEFRA risk program, was mandated as a result of the Tax Equity and Fiscal Responsibility Act (TEFRA) of 1982. This federal law created the current risk and cost contract provisions under which health plans contract with HCFA, and which define the primary and secondary coverage responsibilities of the Medicare program.

Numerous other studies conducted over the last decade have contributed additional evidence of selection bias using a number of alternative analytical measures: pre-enrollee use and costs, mortality rates, self-reported health status, functional status, and health assessment measures of new HMO "joiners." (Riley, Lubitz, and Rabey, 1991; Physician Payment Review Commission, 1996; Riley et. al. 1996; Ingber, 1998). HCFA internal studies of new Medicare managed care enrollees projected average plan payment reductions for this group of between 9 and 18 percent, depending on whether an inpatient or comprehensive risk adjustment model is applied. Though the magnitude of selection bias, and resulting estimated overpayment, varies between 5 and 20 percent, the general conclusion is the same: Medicare HMO enrollees, on average, are healthier than beneficiaries remaining in FFS controlling for the demographic factors used in AAPCC-based payments. Two published studies have found no evidence of selection bias. However, one of these studies was based only on data from two counties in Minnesota, known to be particularly unrepresentative (Dowd, et. al., 1996). The other was based on a very small sample of Medicare managed care beneficiaries (Rodgers and Smith, 1996). The preponderance of evidence suggests that Medicare HMO enrollees are, at least on average, healthier and therefore less costly than FFS beneficiaries of the same age and sex.

Risk Adjustment Research: HCFA-sponsored research to develop improved risk adjusters for Medicare managed care payment began almost immediately following the early selection bias findings. The main focus of this early research was based on the assumption that an individual's health spending was related to diagnosed illnesses. Based on this idea, research focused on using

the diagnosis codes found on fee-for-service claims to explain variation in health spending among individuals. But initially, diagnosis coding of claims was incomplete. The earliest risk adjustment work was based on prior use of services, but suffered from a lack of diagnostic information. Medicare claims data of the early 1980's (Lubitz, et. al., 1985) provided researchers with some information on what services were provided, but not why. The implementation of prospective payment for hospitals vastly improved the diagnostic information available on hospital bills. As a result, the next phase of work focused on inpatient diagnoses as predictors of future health status. "Diagnostic Cost Groups" (DCGs) models were developed based on the premise that, combined with demographic factors, predictable health expenditures were related to hospitalizations (Ellis and Ash, 1988; Ellis and Ash, 1989).

As reporting of diagnoses became better on other types of claims, the next refinement of risk adjustment research took the logical step of combining both ambulatory and in-patient service use information in order to improve explanatory power in predicting total expenditures. The research also focused on systems that avoid direct measures of prior utilization, expenditures, or procedures. Risk adjustment systems that use direct measures bring undesirable incentives for increased utilization or particular modes of practice, and are better for retrospective profiling rather than for payment applications. Because HCFA's primary interest in risk adjustment at this point was for reform of managed care payment systems, funded research used diagnoses as the primary measure of health status.

By 1991, HCFA had begun receiving reliable diagnoses on physician claims and, as a

result, risk adjustment development work was vigorously pursued. Two main directions were taken: models based on Diagnostic Cost Group (DCG) methodologies and models based on Ambulatory Cost Group, now Adjusted Clinical Group (or ACGs) systems. In the case of DCG-based models, the major challenge was the incorporation of outpatient and physician services into the inpatient-based original methodology. Conversely, the ACG models required integration of inpatient services to the original ambulatory care basis of the method.

DCG-based models were developed by a consortium of researchers at Boston University, Health Economics Research and Harvard University School of Medicine, and resulted in the Principal In-patient (PIP-DCG) and Hierarchical Co-existing Conditions (HCC) models (Ellis, et. al., 1996; Pope, et. al., 1997). Research to refine the original inpatient diagnosis driven DCG model was also conducted by the Boston/HER/Harvard consortium; the latest refinement is the PIP-DCG risk adjuster. Parallel developmental research to expand ACG-based risk adjusters was also conducted by researchers at Johns Hopkins University and Lewin (Weiner, et. al., 1996a; Weiner, at al., 1996b). Two new versions developed from the original ACG model are now available: the ADG-HosDom model uses ambulatory and hospital diagnoses as well a category of diagnoses with over 50% hospital admission rates; the ADG-MDC model uses ambulatory diagnoses and a count of hospital admissions by their major diagnostic categories. The ACG and DCG models were developed to prospectively adjust payments (i.e. use diagnostic information from year one to adjust payments in the next payment year.)

In most of the encounter based risk adjustment methods HCFA has developed, the risk

adjustment models can be calibrated to estimate expenditures in two ways: prospectively and concurrently. Concurrent models are typically developed for health status adjustments in research; however, these applications could be applied to a concurrent payment system. What are the differences between prospective and concurrent risk-based payment models? In the prospective models, diagnoses/conditions from a base year are used to estimate future year payments. By their nature, prospective models rely on conditions that have future cost implications. For example, in prospective models, diagnoses related to many cancers have strong importance since a person who is diagnosed with serious cancer in year one is likely to use many health services in year two. In this sense, prospective risk adjustment models base payments on predictable variations in costs.

Concurrent models use current year diagnoses/conditions to estimate current year payments. These models use all conditions identified in the payment year, whether they are randomly occurring or predictable. For example, in a concurrent risk adjuster model, an individual hospitalized for an appendectomy will be placed in a moderate risk category, since this hospitalization had a significant impact on the individual's current year expenditures. Under a prospective model, hospitalization for an appendectomy is not predictive of the next year's expenditures, and therefore this diagnosis would have little impact on a prospectively determined risk score. Therefore, a hospital based concurrent model would be akin to a DRG-model and move closer to a fee-for-service system because of the dominant effect of the hospital stay.

HCFA is proposing a prospective model for implementation for a number of reasons. First, prospective models have been recommended by researchers and actuaries as having fewer

incentives for gaming because they predict future costs rather than reward behavior (Dunn, et al.,1996). Second, prospective models establish final payment rates 3-4 months into the payment year (assuming a 3 month data lag): much sooner than concurrent models (for which final payment rates are not known until 3-4 months after the end of the payment year). Feedback from the managed care industry suggest that plans have a preference for knowing final rates as soon as possible. Finally, prospective models place greater payment weights on diagnoses associated with chronic illnesses, which seems more consistent with the health care management approach of managed care.

Although encounter data based risk adjusters became a primary focus of HCFA sponsored research, alternatives were also sought. As one alternative, HCFA sponsored research on survey-based risk adjusters (sometimes also known as functional status adjusters). These rely on survey information from beneficiaries rather than encounter data (Gruenberg, et al, 1996; Pope, 1997; Kane, et. al., 1998). These models are based on research demonstrating that an individual's perception of his/her own health, estimates of their functional status (measured by Activities of Daily Living (ADLs) and/or Independent Activities of Daily Living (IADLs)), and limited self-reported clinical diagnoses are highly predictive of future health care expenditures (Ware, et. al. 1995; Gruenberg, et. al., 1989). While they do not require encounter data, implementation of payment systems based on survey-based models require surveys of beneficiaries. Such surveys are quite costly. Also, survey data is (by it's nature) self-reported information, and is more prone to error on the reporting of medical history and other factors than claims-reported information. Refined functional status/survey based risk adjuster models specifically for Medicare payment are

still under development. One model of functional status adjusted payment will be tested in the payment system for the Second Generation Social HMO demonstration.[2]

Though much of the risk adjustment development work funded by HCFA was focused on the Medicare population, and intended for potential use in refining the Medicare HMO payment system, research was also encouraged and funded by HCFA to develop risk adjusters for target beneficiary populations, and for non-beneficiary populations. In many cases, risk adjustment development outside of Medicare was prompted by various national health care reform efforts (during both the Bush and Clinton Administrations), in which fears of uneven selection against various health risk pooling organizations was seen as a major potential problem. To meet the policy demands of national health care reform proposals, HCFA funded the development of encounter based risk adjustment models specifically for the under age-65 population (Carter, 1997; Ash, et. al.,1997). In addition to reform related work, research to develop risk adjusters specifically for vulnerable populations was also pursued, though in most cases only partially funded by HCFA. These research efforts have developed risk adjusters for mental health services (Frank, 1997), for children (Newhouse, et. al, 1993), and the disabled (Kronick, 1997). More detailed descriptions of the development of risk adjustment methodologies for the Medicare population, as well as related HCFA demonstration projects, can be found in a HCFA staff-authored article (Greenwald, et. al, 1998).

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[2] The Second General Social HMO demonstration, also known as SHMO II, is intended to test an alternative managed care delivery system for Medicare beneficiaries, some of whom may be nursing home certifiable. Under this project, annual assessments of beneficiaries' medical conditions and functional status are used both for care planning, and as part of payment rate setting for each enrollee.

Actuarial Alternatives to Risk Adjusment: HCFA also funded research to develop non-risk adjustment improvements to the AAPCC (Wrightson, et al., 1996). The approaches considered included risk sharing, partial capitation, reinsurance, experience rating, and an approach that sets different rates for new enrollees to managed care. HCFA offered risk adjustment, as well as these alternatives, to health plans in the Medicare Choices demonstraiton program (Greenwald, et al., 1998). While there was initial interest in the risk sharing and other actuarial approaches, this interest faded once the implementation details were negotiated and plans realized that rates are reduced to fund the risk sharing pools and HCFA was not willing to pursue cost-based approaches. Plan interest in partial capitation also diminished once plans realized that Medicare would only cover Medicare-covered services without large administrative mark-ups for the fee-for-service based share of partial capitation payments.

Choosing a Risk Adjustment Method for Medicare

A large amount of theoretical research has been conducted aimed at developing health status risk adjusters for the Medicare population. But by what standards can one method be chosen over another for implementation? The two standards HCFA used in assessing risk adjustment methods were:(1) model performance and (2) data availability. In the development of risk adjusters, the "performance" of various models has typically been measured by improvements in the amount of explained variation in individual health spending. The demographic risk adjusters currently used in Medicare risk program payment explain about 1 percent of variation in expected spending among individual beneficiaries. This is considered pretty poor. But what is considered

"good" performance of a risk adjustment methodology? Based on previous research, 20 percent is generally considered the current upper bound of explainable variation for the Medicare population; the rest may simply be random or unforeseeable, such as expenditures related to accidents (Newhouse et. al. 1989).

If explaining 20 percent of variation in expected/predictable expenditures is considered the best likely to be achieved, then progress of risk adjusters has been considerable. Explained variation is measured by the "R-square" statistic. Current encounter data based models such as the PIP DCG, the more complex HCC DCG model, and the alternative ACG models, have R-squared statistics between 6 and 9 percent. Survey based models, such as those developed by Gruenberg (1996), have achieved R-squares of about 6 percent for the non-institutionalized, aged Medicare population and about 4 percent for all Medicare beneficiaries. This may not seem very successful, though these figures represent between 30 and 45 percent of the variation considered predictable.

While the R-square statistic is one way to determine relative performance of various risk adjustment methods, it is probably not the most important. R-square statistics measure explained variation among individual enrollees -- in other words, how well the models predict what will happen to individuals. In an insurance application, a more relevant measure is how well the model works for groups. While managed care plans may well be interested in how well these models predict risk scores, and hence payment, for some individuals, their management of risk is based on revenues for groups.

HCFA has therefore placed greater emphasis on assessing the performance of models using predictive ratios. Predictive ratios for groups are the sum of expected expenditures for all individuals in that group as predicted by the risk adjuster model, divided by the sum of actual expenditures observed for all individuals in the group for the year. Comparative information on the performance on various risk adjustment models, according to predictive ratios, is listed in Table 1.1 at the conclusion of this chapter. A predictive ratio of 1.0 represents a perfect prediction of actual expenditures for a group. Ratios under 1.0 indicate under-predicted costs; ratios over 1.0 indicate over-prediction. HCFA evaluated predicted ratios mainly for atypical groups. For large, random groups of beneficiaries, even the demographic factors of the AAPCC system predict well. Comparisons of predictive ratios for different models are more interesting for multiple draws of small, random groups and biased groups, such as: individuals with high versus low health expenditures and groups of people with particular diseases. Analysis of predictive ratios in the context of applied risk adjustment is particularly important since some HMOs (particularly small ones) may not enroll a random beneficiary case mix. In those instances, the risk adjustment methodology must be reasonably accurate, and an improvement over the current system. Performance of the models based on predictive ratios has convinced many researchers that current analytical models are as good as they are likely to get using diagnosis data.

Encounter data: The other factor affecting selection of a risk adjustment method relates to the data required to implement them. In regards to data requirements, currently available risk adjustment models all require basic demographic information, such as age and sex; this information is available for Medicare beneficiaries as a part of HCFA's current administrative data

systems. In addition to demographic information, current risk adjustment models require either diagnostic information from individual visits (generally referred to as "encounter data") or enrollee-reported health status information such as diagnoses and functional status limitations (often referred to as "survey data" since the information is collect through survey methods). Though both survey and encounter based models require significant new data collections, encounter data is generally perceived as the more data intensive approach. This "encounter data problem" was a major reason why implementation or even testing of risk adjusted payment has been very slow. There has been a great reluctance to mandate encounter data, as well as uncertainty as to whether complete data are even available from many Medicare HMOs. Until recently, availability and quality of encounter data obtainable from Medicare HMOs was unknown. There is reason to believe that, given recent advances in information technology, the costs of collecting and transmitting the large amounts of data necessary to implement risk adjustment have dropped. Many plans may also be collecting encounter-type data as a critical tool in managing care, quality, and costs.

For implementation of risk adjusted Medicare+Choice payments, availability of data became the binding constraint behind selection of a risk adjustment model. As noted previously, BBA mandates the collection of inpatient encounter data, with submission beginning in January 1998. The connection between the collection of inpatient encounter data and risk adjustment by calendar year 2000 implies implementation of an inpatient data only based system for the first few years. Thus, for implementation in 2000, the risk adjustment method has to rely on only inpatient diagnostic information, paired with administrative data already obtained as part of HCFA's

current data system.

Given the importance of the collection of managed care enrollee data in driving the selection of Medicare's risk adjustment approach, it is important to briefly describe HCFA's data collection process. More detailed information is available as an appendix to this chapter. Collection of managed care encounter data has been viewed as a difficult undertaking for two primary reasons. First, as a major new data collection activity, HCFA had to be comfortable that it had both the authority and resources to carry out this requirement. Second, even with appropriate authority and resources, collection of these data present enormous technical issues for both HCFA and the Medicare managed care plans. Issues of authority and resources were more or less addressed through the BBA, which requires Medicare +Choice organizations (and eligible organizations with risk-sharing contracts under section 1876) to submit inpatient hospital data for periods beginning on or after July 1, 1997. Other data as the Secretary deems necessary may be requested for periods beginning on or after July 1, 1998. The general approach for the collection of managed care encounter data was described in the Medicare +Choice regulation. The regulation also identified two future dates for the collection of other encounter data. That is, hospital outpatient, SNF, home health, and physician data will be collected after October 1, 1999, with all other data collected on or after October 1, 2000. A definite schedule for the collection of these data has not yet been determined.

Regarding the building of the technical systems to actually implement the mandate, within 2 months of passage of the BBA, HCFA began to meet with managed care and hospital industry

representatives over the requirement to obtain hospital inpatient data, retroactively to July 1, 1997. In these meetings, possible problems were identified that plans and hospitals were likely to face when attempting to recover data for managed care enrollees. As a result of these discussions, the process for submitting encounter data was defined according to two time periods: (1) the "start up year", or hospital encounter data for discharges from July 1, 1997 - June 30, 1998, and (2) "ongoing implementation", or encounter data from July 1, 1998 forward. During the start-up year, plans were allowed multiple options for data formation (including the full UB-92 format, and a summary format), as well as three alternatives for data submission (by the plan, by the hospital, and by a third party).

Encounter data received from plans for the start up year was compiled into a data base for the purposes of risk adjustment. This data base was constructed by a HCFA contractor, Fu Associates. Along with HCFA staff, the contractor reviewed the start up year encounter data set for patterns of submission that might suggest either missing data or duplicate data. The contractor was also responsible for linking data at the enrollee level. For some beneficiaries, this required linking of data from multiple plans, or combining FFS and plan data, to create for each managed care enrollee a complete year of data encompassing July 1997 to June 1998. In addition, all enrollees in managed care were represented in this data base, even if no claims were submitted by a plan or plans, by their demographic information linked from the HCFA eligibility and enrollment files.

Through November 1998, HCFA received approximately 1.4 million claims from

managed care plans. Initial data from the start-up year have been used to estimate impacts. Data received and processed through January 1999 will be used to provide plans with an estimate of their Average Payment Rate (APR), which in turn will be used by plans in the preparation of their Adjusted Community Rating Proposal (ACRP) for CY 2000. These data will **not** be used for payment. Encounter data from a subsequent period (e.g., July 1998 - June 1999) will be used in determining risk adjustment payments for Medicare +Choice plans for CY 2000.

The Principal In-Patient Diagnostic Cost Group Model

Given the availability of data limited to inpatient encounters, the risk adjustment approach most feasible for implementation by 2000 is the Principal In-Patient (PIP) Diagnostic Cost Group (DCG) model, or the "PIP-DCG." Given the limitation of an inpatient-only risk adjustment approach (which will be discussed in greater detail in this report), HCFA views implementation of the PIP-DCG model as an interim step in the development of risk adjusted Medicare+Choice payments. As the collection of full encounter data (i.e. diagnoses collected for all sites of service) becomes feasible, HCFA proposes to replace the PIP DCG methodology with a comprehensive risk adjustment model. This longer term approach will be discussed more fully in Chapter 5.

Briefly, under the PIP DCG model, diagnostic codes from inpatient encounter data are used to place individuals in one of 15 diagnosis-based payment groups, each corresponding to a range of expected health expenditures. Although there are a small number of groups, hundreds of hospital based diagnoses are contained in these groups. Individuals are assigned to a single PIP-

DCG group based on the principal diagnosis they experienced in that year that has the greatest future cost implications. The model also uses age, sex, original reason for Medicare eligibility (disability) and entitlement to state payments for Medicaid, to derive a predicted payment. These factors are used for enrollees who are not assigned to an inpatient diagnostic group. Because this model was developed and calibrated using a year of inpatient diagnoses, a full year of data is essential for reliable estimates. The model is also prospectively based; in other words, base year inpatient diagnoses are used in the model to predict future payment year health expenditures.

The PIP DCG risk adjustment model is a refinement of the early DCG risk adjuster developed by Boston University, and tested by HCFA in the DCG demonstrations of the early 1990's. The main difference between the PIP DCG and the former DCG model is a more refined sorting algorithm using a wider range of diagnoses and a few more diagnosis cost categories (currently 15 instead of 10). HCFA has also re-calibrated this prospective PIP-DCG model using 1995 hospital diagnoses to predict 1996 actual Medicare expenditures. More detail on the PIP DCG model proposed for year 2000 risk adjustment implementation will be presented later in Chapter 2 of this Report.

In practice, the PIP DCG model simply adds one dimension to the current payment system in the following way: when a managed care plan enrolls a Medicare beneficiary today, they forward the information to HCFA, and they receive a confirmation of the information necessary to establish the appropriate demographic factor: county of residence, age , gender, and eligibility category. Payment is then determined by multiplying the factor times the appropriate county rate

book amount. Under PIP DCG risk adjustment, an additional step is required for HCFA. After plans submit hospital encounter data, HCFA will use this information along with its records on fee for service use, to determine the appropriate risk cell for each beneficiary. Essentially this requires a look-up table of inpatient principal diagnoses associated with each risk cell. When the plan forwards enrollment information to HCFA, HCFA in turn sends the plan the appropriate risk cell information, verification of the demographic data, as well as the resultant payment factor. Payment is then determined by multiplying the individual risk factor times the appropriate county rate book amount.

As different as this system for risk adjustment may appear, Medicare is pursuing aspects of payment approaches already implemented by a number of States and private groups. The next section of this chapter will highlight other relevant public and private sector experiences with risk adjusted payments.

State and Private Sector Experiences in Health Status Risk Adjustment

Because health status risk adjustment is evolving, there was limited experience from which Medicare could draw upon in proposing a model for the Medicare+Choice program. Still, health status risk adjustors are gaining acceptance as capitated delivery approaches increase in public sector programs. Twelve states use some risk adjustment mechanism to adjust premiums for their state employee health programs (Lewin-VHI, 1995). Capitated payment systems in state Medicaid

1115 waivers all use some variant of risk adjustment. Common elements of these payment approaches are assessed below, after which the case studies are presented.

Common Elements of Other Risk Adjustment Systems

Refined risk adjustment methodology. A number of new and existing capitated programs that originally applied demographic-only risk factors (similar to the pre-BBA adjusters applied as part of the AAPCC methodology) are now moving towards more sophisticated diagnosis-based models, such as variants of the DCGs and the Hopkins ACG. For these other programs, their rationale for this change is the same as for Medicare; demographic-only adjusters proved inadequate, and diagnostic-based models offer significant improvement in accuracy. For example, the Washington Health Care Authority and the Minneapolis Buyers Health Care Action Group (BHCAG) have substituted their former demographic-only risk adjustment factors with some version of a demographic plus diagnostic/claims type system. The proposed Medicare+Choice program similarly moves towards a more a sophisticated risk model, the PIP-DCG, which uses inpatient diagnosis and demographic information to classify patients into risk groups, and will move to a more comprehensive model over the next 4 to 5 years.

Plan submitted encounter / claims data. To implement many of these more sophisticated models, plans must submit data at the individual member level. The more sophisticated the risk model, the greater the data requirements. Of the case studies presented here, all payers required enrollee data from plans, ranging from basic demographic to all claims data, as in the Maryland

HealthChoice program (inpatient, outpatient, physician, and pharmacy). The reliability of plan submitted data has prompted several systems to use an abbreviated data collection form, which has also resulted in the use of less sophisticated risk adjuster models. The Medicare+Choice program currently requires only the submission of inpatient encounter data, although, a full model risk adjuster model (which HCFA plans to move toward in the future) will require additional claims data.

Payer provided stop loss insurance. Stop loss insurance has been used by several payors including: MinnesotaCare, Maryland HealthChoice, and the Minneapolis Buyers Health Care Action Group. Under this arrangement, rates are reduced by the actuarial value of the stop loss insurance provided by the payer. In the Maryland HealthChoice program, stop loss coverage is provided for individual annual hospital inpatient care costs in excess of $50,000 (threshold in the initial year) and the plans are responsible for 10% of the costs in excess of the threshold. This arrangement gives the plans an economic incentive to manage the care even with the stop loss insurance in effect. A variation of this concept is the adjustor for low enrollment size, which is used in the Colorado Medicaid payment system. The proposed Medicare+Choice does not provide stop-loss coverage or make any adjustment for plan size.

A phase in period. Phase in periods have been used where extreme redistribution of payments is forecast. For the Washington Health Care Authority, the transition policy for 1998 was a 2 percent corridor around the demographic payment. Risk based payments which fell into this plus/minus 2 percent corridor were not modified. Risk based payments outside this corridor

were subject to the floor or ceiling 2 percent amounts. Medicare will also use a phase in, or transition period, which will be described later in Chapter 3 of this Report.

Service carve outs. In some programs, certain services are "carved out" of the capitated rates, particularly mental health. The Maryland HealthChoice Medicaid program has a mental health carve out. The Medicare+Choice proposed risk adjustment model has no service carve outs.

Case Studies of Selected Public Sector Programs

State employee health plans: The Washington Health Care Authority (HCA) is a cabinet level agency in the Washington State government that purchases health benefits for 450,000 public employees, retirees, and Basic Health enrollees using a competitive approach. Managed care plans bid a capitated rate for a standard benefit package. After an open enrollment period, the demographic characteristics (age/gender/member status/retiree status/COBRA status) of each plan's enrollees are used to retroactively adjust final plan payments. A demographic model has been used to adjust payments to health plans since 1988. Each risk category has a weight, which when aggregated by the number of enrollees and summed across all risk cells, results in the final payment. Health status adjustors, using a 13 category DCG model, are scheduled to fully replace demographic-only risk factors by the year 2000 after a 2 year phase-in period. This DCG based model uses both inpatient and ambulatory diagnostic information collected in the form of encounter data. Encounter data, submitted by plans, was used to compute the health status

adjustment weights at the start of the transition year, 1998. These weights, which were computed from 24 month old data, are being refined for the year 2000 phase out of demographic-only adjustors. Health plans will receive a concurrent retroactive payment for the enrollee characteristics in a given plan year, based upon the final weights.

While information is not yet available on the first phase implementation of health status adjusted payments, HCA simulated its payment compared to the demographic-only adjustment model. A fully phased-in, hypothetical health status adjusted model would generate significant changes in payments, compared to the existing demographic model. Data quality problems were blamed for some of the wide redistributional effects. To minimize the redistribution and to allow more time for health plan to build and improve their data collection system, a 2 year phase-in period, to the year 2000, was considered essential (Wilson, et al., 1998).

State purchasing cooperatives. The California Health Insurance Plan (HIPC) was established by a 1992 California statute enabling the establishment of a small group purchasing pool. The concept was to give small employers market power that paralled that of larger plans. Risk adjustment was used to promote access by minimizing the risk of loss by participating plans. which could result from adverse selection. Plans negotiated capitated contracts with HIPC, which would later be adjusted for enrollee risk factors. These initial risk adjustors included: gender, family size, and a simplified health status measure based on inpatient data. After a risk assessment of the HIPC enrollees, plans with risk characteristics higher or lower than a 5% corridor received retroactive settlements. Plans within the risk corridor received no adjustment.

The Minneapolis Buyers Health Care Action Group (BHCAG) offers an example of a more complex risk adjusted payment system. The BHCAG contracts with plans to provide capitated products to its 250,000 covered lives. Participating plans bid to provide standardized packages of services. After an enrollment period, the bids are retroactively adjusted using the Hopkins Adjusted Clinical Groups or ACGs. The ACG model requires both inpatient and ambulatory encounter data. Each quarter, the adjusted rates for a rolling 12 month period are compared to the actual fee for service payments and an adjustment is made in the following quarter. Administrative costs, out of network claims, and catastrophic claims (90% of hospital costs (inpatient/outpatient) above $30,000) are excluded from the capitated system and retroactive adjustments, since these costs are paid by other mechanisms (Knutson, et al., 1998).

State Medicaid Programs. The State of Maryland's risk adjusted payment system is closest conceptually to the proposed model for Medicare+Choice. In July 1997, Maryland began a six month phase in of a managed care, capitated approach to pay for the health services of approximately 84% of the Medicaid beneficiaries in its HealthChoice program. Populations excluded from the system include the dually eligible, very high cost beneficiaries, and institutionalized beneficiaries who are treated in chronic and long term rehabilitation hospitals and nursing homes. Care is provided by HMO's and Managed Care Organizations (MCO's), which receive a monthly capitated amount to cover all medical care of each beneficiary. Mental health care was carved out of the rates and is provided as a separate specialty managed FFS delivery system. Beneficiaries have a 30 day period to select an HMO or MCO, after which time they will be automatically assigned to a plan. They may disenroll at any time for cause and may change

plans during the annual open election period.

In Maryland, capitated rates were established in the first year as a fee for service (FFS) equivalency and were not competitively bid. MCO's and HMO's are required to spend at least 80% of the rate on medical services (to be increased to 85% after 1997). Consequently, they must annually report their profit and losses on the Medicaid business. If the medical service ratios are less than required, the State may adjust the rates. Health plans must submit patient level encounter data (inpatient, outpatient, physicians, pharmacy) to the State, which compiled a patient level data base to determine risk cell payments (State of Maryland, 1996). The FFS data was adjusted to reflect: 1) the provision of stop loss insurance, 2) a mental health carve-out, 3) projected managed care savings of 10%, 4) eliminated marketing costs, and 5) supplemental care carve outs for labor and delivery, neonates, and AIDS patients. In the second year, the rates exclude teaching (GME and IME) costs, since they will be paid directly by Maryland Medicaid to the teaching hospitals

For beneficiaries with less than 6 months claims experience and without an AIDS diagnosis, the capitated rates were assigned to one of 44 payment cells using only demographic factors (age / gender / location: Baltimore, all other areas) and health status (disabled/AFDC-like). Beneficiaries with 6 months or more claims experience were assigned a health status risk category using the Johns Hopkins ACG classification system. In this grouping scheme, the 44 demographic and health status categories are replaced with 17 ACG categories. Age, location, and gender drop from the risk adjustment scheme. The ACGs are grouped into 17 Resource

Adjusted Categories (RACs) with 9 representing AFDC like patients and 8 representing disabled patients. A person with an AIDS diagnosis is assigned to a payment cell differentiated only by location. In the second year of the Section 1115 waiver, the number of rate cells increased by one disabled RAC category (CHPDM, 1998).

In its second year of operations, the Maryland HealthChoice plan described itself as following the HCFA model. Many attributes are similar, including the use of a sophisticated risk model, the use of demographic only data for enrollees lacking claims experience, the absence of negotiation or bidding by plans, and the differentiation of the rate cells by location. There are several differences. Participation in the plan is mandatory for eligible beneficiaries, although they do have a choice of plan providers. Stop loss insurance is used to protect plans from catastrophic losses. With a great number of similarities to the federal program, the experience in Maryland may portend the direction of a health status risk adjustment model at the national level.

The State of Colorado, like Maryland, is also implementing a claims based risk adjustment system. Under Colorado Medicaid's voluntary participation program, 7 HMOs care for about 30% of the eligible Medicaid population. Prior to fiscal 1997, HMOs were paid a flat rate using a 7 category payment matrix (age and eligibility type: AFDC, disabled), and a 2 category geographic adjustor (urban Denver/ rural). The rates were based on fee for service claims experience, discounted by a statutory 5%. Since this system did not differentiate severity, some plans could financially benefit by accepting the less severely ill, which would shift the treatment burden to other plans. Plans that experienced a higher than average case mix would suffer

financially under this flat rate system.

To remedy this inequitable payment structure, Colorado Medicaid proposed a diagnosis based risk adjustor system termed the Disability Payment System, which was designed by Kronick in 1996-97. This system grouped diagnoses into 43 major categories, which were supplemented by 10 demographic and geographic factors. Encounter data submitted by the plans for 1996 was used to develop a case mix factor for each HMO. If there were an insufficient numbers of enrollees, the predictability of the risk adjustor was considered unreliable at the plan level. Case mix was adjusted for plan enrollees below a threshold by using an averaging technique. Kronick found that participant sample sizes approached the population mean at 500 (disabled enrollees), 1,500 (adults), and 2,500 (children). The averaging formula adjusted the case mix of plans having enrollments especially below two-thirds of the thresholds. The system was implemented in 1997.

As a result of the Disability Payment System, total HMO premiums were increased slightly, by 2%. Some HMO's, such as Kaiser, experienced rate declines (-8.5%) as a result of serving a lower case mix, while others gained, particularly the University of Colorado Children's Hospital. The first year reaction to this payment system by the plans was generally favorable, although the one with the largest rate reduction, Kaiser, gave notice that it would freeze its Medicaid enrollments at the 1997 levels. The health status risk adjustors are being refined by Kronick and his colleagues (Tollen and Rothman, 1998).

Review of HCFA's Risk Adjustment Methodology

The BBA mandate, aside from requiring this Report to Congress outlining HCFA's proposed methodology, also required an independent actuarial review of the proposed method. To meet this requirement, HCFA arranged for a panel of experts under the aegis of the American Academy of Actuaries to review and comment on the risk adjustment model and its application in Medicare+Choice payments. In summary, the Academy found the PIP-DCG based payment method as proposed by HCFA to be actuarially sound; they conclude: "On balance, and with a phase-in, the proposed risk adjustment method appears to be a reasonable first step in what should be a long-term evolutionary process." Their comments are discussed in Chapter 5, and their review report is attached as Appendix 4.

Outline of the remaining chapters

The remainder of this Report will present greater detail on the following aspects of risk adjusted payments for Medicare+Choice plans:

- Chapter 2 will present full detail on the PIP-DCG model, proposed by HCFA as the risk adjustment model for year 2000 implementation. This chapter will describe the process used in developing and refining this model, as well as the final model parameters.
- Chapter 3 will describe how risk adjusted payments will be accomplished in the context of the Medicare+Choice payment system. Details on the calculation of the Medicare+Choice rate book, and the need for a county level conversion factor, will be presented, as well as HCFA's plans for a phase in period.

- Chapter 4 will present a detailed impact analysis of the probable effects of implementation of risk adjustment.

- Chapter 5 will summarize the proposed methodology for implementation in January 2000, and provide an overview of the mandated independent actuarial review conducted by the American Academy of Actuaries. The chapter will also describe HCFA's proposed approach to risk adjusted Medicare+Choice payments in the longer term.

Table 1.1: Explanatory Power of Alternative Encounter Data-Based Risk Adjustment Models

All Enrollees	R-Squared
AAPCC	1.0 %
PIP DCG	5.5 %
HCC	8.6 %
ADG-MDC	6.3 %
ADG-HOSDOM	5.5 %

Biased Groups	Predictive Ratio
Enrollees with Diagnosis: Depression	
AAPCC	0.58
PIP DCG	0.89
HCC	0.93
ADG-MDC	0.99
ADG-HOSDOM	1.02
Enrollees with Diagnosis: Chronic Obstructive Pulmonary Disease	
AAPCC	0.68
PIP DCG	0.80
HCC	0.98
ADG-MDC	0.94
ADG-HOSDOM	0.92
Enrollees with Diagnosis: Diabetes without Complications	
AAPCC	0.63
PIP DCG	0.75
HCC	1.02
ADG-MDC	0.85
ADG-HOSDOM	0.86
Enrollees with Diagnosis: Acute Myocardial Infarction	
AAPCC	0.45
PIP DCG	0.82
HCC	1.01
ADG-MDC	0.88
ADG-HOSDOM	1.01
First (lowest) Quintile Expenditures	
AAPCC	2.49
PIP DCG	1.92
HCC	1.21
ADG-MDC	1.19
ADG-HOSDOM	1.08
Fifth (highest) Quintile Expenditures	
AAPCC	0.48
PIP DCG	0.85
HCC	0.88
ADG-MDC	0.92
ADG-HOSDOM	0.88

CHAPTER 2: DERIVATION OF THE PIP-DCG MODEL

This chapter will address the development, estimation and evaluation of the Principal In-Patient Diagnostic Cost Group (PIPDCG) risk adjustment model that is the basis of the proposed payment system for M+C plans. This model, developed by researchers at Health Economics Research, Inc.,Boston and Brandeis Universities, and the Harvard University School of Medicine under funding by HCFA, is the risk adjuster model developed for Medicare which can be implemented using only in-patient data. The derivation and calibration of the model proposed here was a multi-step process, involving economists, other health services researchers, physicians, and policy analysts.

The DCG methodology was originally developed in 1986 by Ash, et. al. (1986). This early work used Medicare FFS data from 1974-1980, and formed the basis for later PIPDCG work. The PIPDCG approach uses diagnostic information from hospitalizations occurring during a base year and Medicare costs from the subsequent year to classify beneficiaries into cost groups. These cost groups, PIPDCGs, together with demographic characteristics are then used to predict Medicare cost in a subsequent year. This original 1986 model was enhanced by Ellis and Ash (1988) using data from 1984-1985. Further refinements to the model were made including those described in Ellis and Ash (1989); Ash, Ellis, and Iezzoni (1990); and Ellis and Pope, et. al. (1996). The model that forms the basis of the proposed payment system is described in Pope and Liu, et. al (1999). It is included as Appendix 2 to this report.

Models that use only diagnoses from the in-patient setting have inherent strengths and weaknesses. Its greatest strengths are that: 1) the data are readily available; and 2) the model predicts costs far better than the existing demographic variables in the AAPCC. In-patient diagnosis data are easier to obtain because hospitals generally maintain sophisticated claims processing systems consistent with Medicare requirements. Parallel claims systems in other sites of service vary in terms of sophistication. In addition, in-patient diagnoses are likely to be more accurately coded and easier to audit than diagnoses from other sources. To the extent that in-patient admissions are a proxy for severity of illness and greater expected costs, an in-patient-based adjuster can work sufficiently well until a full encounter model can be implemented.

In-patient models, however, do have limitations. One concern is that a payment system where plans are paid more if a beneficiary is hospitalized creates an incentive towards hospitalization. Because payment will be made on the basis of the principal in-patient diagnosis, there will also be an incentive to reorder diagnoses to potentially game the system. To a certain extent, these problems of inappropriate incentives can be addressed, by filtering out short stays or diagnoses that are only infrequently treated in in-patient settings. A hallmark of managed care plans since their inception has been the emphasis on preventive services which should lead to lower hospitalization rates in managed care than in the fee for service population. Thus, models that increase payments based on hospitalizations are contrary to the managed care paradigm. On the other hand, decreased hospitalizations have the effect of reducing costs of care.

Data Used to Develop the Risk Adjustment Model

To properly calibrate the model, it was of paramount importance to correctly define the input data. The sample frame included the universe of beneficiaries appearing in HCFA's five-percent Standard Analytic File sample who were alive and enrolled in Medicare on January 1, 1996, and the entire year of 1995. From this universe, the 1995-1996 modeling sample was defined by excluding the following:

1. beneficiaries covered under the End Stage Renal Disease (ESRD) program during any time during 1995 or 1996;
2. beneficiaries who were not continuously enrolled in both Part A and Part B Medicare for the entire period January 1, 1995 to December 31, 1996, or the period from January 1, 1995 until the month of their death or entrance into a hospice during 1996;
3. beneficiaries enrolled in a Health Maintenance Organization (HMO) at any time during 1995 or 1996;
4. beneficiaries who reported their state of residence as outside the 50 states and Washington DC during 1995 or 1996; and
5. beneficiaries who entered hospices on or prior to January 1, 1996.

Beneficiaries in the ESRD program were excluded because they are a distinct, high cost group with a separate reimbursement system. The second exclusion criterion imposes the requirement that beneficiaries in the sample are eligible for all of 1995 and that all of their 1995 claims for identifying diagnoses exist. It also imposed the requirement that a full set of 1996 claims on which to estimate their costs also exists. This sample excluded any one becoming eligible during January 1, 1995 to December 31, 1996. Thus, new Medicare eligibles (e.g., 65 year olds) are not present in the prediction year (1996) of the sample. However, the sample includes both people who lived on into 1997 and those dying during 1996.

The fifth exclusion ensured a complete 1995 diagnosis profile for the study sample. Hospice care is primarily palliative, and so diagnostic information on hospice residents may be incomplete. Moreover, Medicare regulations specify that Medicare+Choice plans are not responsible for hospice care, so predicting expenditures for hospice residents is not relevant to the Medicare+Choice program. For the purpose of data construction, if a beneficiary entered a hospice in 1996, collection of cost data ended at that time and the beneficiary is treated as if he is enrolled only until that month. Thus, if a beneficiary entered a hospice on March 15, he is treated as if he is enrolled in FFS for 3 months. The exclusion process removed less than 50,000 beneficiaries from the data base. The final study sample included approximately 1.4 million Medicare beneficiaries.

Development of the Principal Inpatient Diagnostic Cost Group (PIP-DCG) Model

In constructing a risk adjustment model, it is important to determine which set of conditions should be used to adjust payments. Under the current AAPCC payment system, all enrollees are placed in a base group paid according to demographic characteristics. In the PIP-DCG risk adjustment system, hospitalizations are used as markers for a particularly ill and high cost subset of beneficiaries for whom higher payments will be made in the next year. However, the costs associated with beneficiaries who have been hospitalized are no longer in the base payment category. Payments for people in the base payment category decrease as payments are increased for beneficiaries identified as high cost.

Because an inpatient diagnosis-based system depends on a person's site of service, only a subset of conditions should be recognized for increased payments. That is, the system should recognize admissions for which inpatient care is most frequently appropriate and which are predictive of higher future costs. For example, admissions for diseases most commonly treated on an outpatient basis should remain in the base group and should not be used for upwards adjustment.

While the PIP-DCG model uses only inpatient diagnoses in creating the risk adjustment classification system, the model *predicts total expected costs* for the following year across multiple sites of services. Consequently, all Medicare expenditures, other than those for hospice care, were included in the calibration. Medicare expenditures for hospice care were not included because Medicare+Choice organizations are not responsible for hospice care. The model was estimated assuming no time lag between the data collection year and the predicted expenditures; that is, calendar year 1995 beneficiary diagnoses were used to predict calendar year 1996 expenditures.

From Diagnosis Groups (DxGroups) to PIP-DCGs

Diagnostic classification: The risk adjustment model estimation process begins with a classification system, forming the inherent logic of the model. For the PIP-DCG model, principal inpatient diagnoses are classified into diagnosis groups (DxGroups). The DxGroups comprise an exhaustive classification of all valid International Classification of Diseases, Ninth Revision,

Clinical Modification (ICD-9-CM) diagnostic codes. The primary criteria used in forming the DxGroups were clinical coherence and an adequate sample size to estimate average expenditures. More specifically, all DxGroups are based on the following principles:

- DxGroups separate diagnoses by anticipated costliness;
- DxGroups should have a sample size of at least 500, when clinically possible;
- DxGroups should be clinically homogeneous and meaningful;
- Alternative codes that can be used for the same medical condition should be grouped together; and
- Each reimbursable ICD-9-CM code should belong to one and only one DxGroup.

Beneficiaries with multiple different inpatient diagnoses resulting from multiple hospital stays, and would be assigned multiple DxGroups.

Creation of Preliminary PIP-DCG groups: Next, DxGroups were aggregated into payment groups, or PIP-DCGs, using a sorting algorithm that ranked DxGroups based on 1996 actual expenditures. Highest expenditure DxGroups were grouped into the "highest" PIP-DCG. Once beneficiaries with the highest costs were placed into a DxGroup, those beneficiaries and all their associated expenditures were removed from the data for other DxGroups and then the DxGroups were re-ranked. The DxGroups with the next most costly diagnoses were grouped into the next highest numbered PIP-DCG, and those beneficiaries were removed from the remaining DxGroups. The process was repeated until each beneficiary and his or her expenditures

were assigned to a single PIP-DCG group. Beneficiaries with multiple inpatient diagnoses were placed in their highest expenditure PIP-DCG group.

In this way, each PIP-DCG group was defined according to average total expenditures for beneficiaries with inpatient diagnoses, which were first categorized, grouped, and sorted using the DxGroups. Using this sorting algorithm, more than 20 initial PIP-DCGs were defined. Lower average expenditure PIP-DCG groups had narrower cost ranges (or intervals), while the highest average expenditure PIP-DCG groups had wider ranges.[3]

Modifications to the PIP-DCG Model

Ultimately, not all DxGroups remained in their sorted PIP-DCG group placement. A number of DxGroups were excluded from their original PIP-DCG placement because it is not desirable to trigger higher payments for all inpatient diagnoses. Attaching future higher capitation payments to principal inpatient diagnoses can incentivize admissionsl. If all diagnoses were considered for higher payments, even relatively healthy people might be admitted for minor diagnoses in order to obtain higher payments. Excluding minor or nonspecific diagnoses that do not clearly require hospital care improves the equity of the model. Unlike a unit of payment

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[3] The PIP-DCG groupings were further refined using a number of criteria. First, each original PIP-DCG group retained its identity in the final payment model only if it contained at least 1,000 beneficiaries in the original sample; this minimum sample size was defined to assure stability of estimated payments in the model. If sample sizes were smaller than 1,000, the potential PIP-DCG was expanded to include DxGroups with average expenditures in the next lower range until the sample size was satisfied. If at any time during the sorting algorithm a DxGroup had fewer than 50 beneficiaries assigned to it, it was assigned to the base payment category. This base payment category also included all beneficiaries (and expenditures) for whom there was no inpatient diagnosis during 1995.

system such as the Diagnosis-Related Groups (DRGs), the aim is not to reimburse plans for each hospital admission. For these reasons, the following general criteria were established to exclude DxGroups from their sorted PIP-DCG destinations:

- The DxGroup represents a clearly defined and clinically significant disease, disorder, state, or event;
- The DxGroup contained diagnoses often requiring inpatient hosptial care, even in a managed care setting;
- The DxGroup predicts higher future medical costs.

Unlike the preliminary sorting of DxGroups, final placement of DxGroups into PIP-DCG groups was not an automatic decision algorithm. Rather, these decisions were driven by a clinical panel of experts, contractor research staff, and HCFA staff analysis using clinical and policy-conscious judgement.

Admissions not selected for higher payment: After the initial sorting of DxGroups into PIP-DCG groups was complete, a clinical panel reviewed the placement of the DxGroups and their resulting predicted expenditures, to determine the appropriateness of their application in a payment model. Through this process, 75 DxGroups (covering about 1/3 of the admissions) were identified as: (1) representing only a minor or transitory disease or disorder, not clinically likely to result in significant future medical costs, (2) rarely the main cause of an inpatient stay, or (3) vague or ambiguous. These groups, as recommended by the clinical panel, were identified as

those most likely to result in inconsistent or inappropriate reimbursements and were placed (with their associated expenditures) in the base payment category (for which the payment is a function of demographic factors). Examples of these groups include the DxGroup for fluid/electrolyte disorders and malnutrition. Though the treatment for individuals with this diagnoses are often quite costly in the following year, the diagnosis is clinically vague and, therefore, represented a likely target for coding "creep." The clinical panel concluded that many of the sickest individuals with this diagnosis were likely to have another more specific hospitalization that would trigger appropriate increased reimbursements. After this reconsideration, the remaining DxGroups were resorted and placed into revised DCGs for the payment model. A total of 15 PIP-DCGs (above the base payment category) are included in the final payment model. Costs for persons with excluded admissions, as well as no admissions, are included in the demographically-based payment amounts, as they are under the current Adjusted Average Per Capita Cost (AAPCC) system.

Short stays: As a second strategy to ensure consistent and appropriate payment levels, beneficiary diagnoses reported as a result of a short hospital stay (1 day or less) were left in the base payment category. Since the majority of 1-day stays are for diagnoses already assigned to the base group, the effect on payment of placing all 1-day stay diagnoses in the base group is small. Also, short stays are often indicative of less serious, and, hence, less costly cases. It is important to note that these modifications do not mean that these expenditures have been excluded from the model. Rather, the payments associated with these diseases are captured in increased payments for the base payment category.

Industry concerns: We received a number of comments from plans (based on the September 8, 1998 notice) regarding this decision to "exclude" 1 day stays from the final PIP-DCG groups. Related comments expressed managed care industry concern that a risk adjustment model based only on inpatient diagnoses, particularly one which further excludes short stays, would disadvantage some plans and not provide "credit" for management on an outpatient basis. In response, we must stress that the purpose of the PIP-DCG model is to serve as an interim step towards implementation of a comprehensive risk adjustment model (i.e. one which uses diagnoses from all sites of service). The current AAPCC model makes no adjustments for level of illness, chronic or otherwise. The goal of the PIP-DCG model is to offer an improvement over the current system by identifying a relatively small group of high cost, serious illnesses, and provide a marginal additional payment appropriate for these seriously ill beneficiaries.

Another rationale for the exclusion of one day stays was to limit possible "gaming" of the new payment system. Plans that might convert treatment of some diseases from outpatient to one day admissions, increase the frequency of short "observational" stays, and otherwise increase the use of short hospital admissions for marginal diagnoses, would trigger potentially large increased payments for relatively low cost (the costs associated with a one day hospital stay). To further refine the model as a method of identifying the sickest individuals, and to discourage the potential payoff for gaming, we excluded one day stays of any diagnoses for the purpose of triggering increase PIP-DCG payments. A HCFA analysis of the extent fo which there is any effect on plan payments due to the one day stay policy revealed an effect on only a few tenths of one percent.

We placed in the base payment category all vague, non-predictive, and/or marginal diagnoses, as well as diagnoses resulting from one day stays. As a result, only a subgroup of seriously ill beneficiaries remains identified for increased payments. In restricting the adjustment to a small proportion of beneficiaries, the system makes only an incremental change to the current demographic-only system. It is important to recognize that, on average, payments for all beneficiaries remaining in the base category (88 percent of all beneficiaries) are based on demographics, as in the current system. To the extent that Medicare+Choice organizations have had favorable selection when payment is based on demographics, we will continue to overpay for this group.

In regard to plans' concern about the bias in the PIP-DCG system against outpatient management of chronic illnesses and higher incidence of short stays, we agree that a comprehensive model is preferable, and we plan to move toward implementing such a model as expeditiously as possible. However, implementation of the comprehensive risk adjustment model is not operationally feasible for 3 to 4 years, because of data constraints on both plans and HCFA. In the interim, the PIP-DCG model offers a substantial improvement over the current system.

Diagnostic exceptions: Under the final payment PIP-DCG model, beneficiaries who are hospitalized for chemotherapy (ICD9 codes V58.1 and V66.2) are treated as exceptions. These codes are indicators of a treatment method, rather than a particular disease. Recognizing, however, that Medicare's current inpatient coding rules require that the diagnoses for beneficiaries who are hospitalized for chemotherapy must be coded using these V-codes as the

principal diagnoses, the most appropriate PIP-DCG group for these beneficiaries would be assigned based on the type of cancer, using a secondary diagnosis. In addition, the final payment model also treats individuals diagnosed with AIDS as an exception. In this case, individuals with a secondary diagnosis of AIDS will be placed in the same PIP-DCG group as individuals with a reported principal diagnosis of AIDS. The rationale for this decision is HCFA's analysis showed that individuals with a secondary diagnosis of AIDS tended to have expenditures close to those admitted explicitly for the treatment of AIDs.

The final mapping of the DxGroups to the PIP-DCG groups is shown in Table 2.1.

Addition of Demographic and Other Factors

Age and Sex: Twenty-four age/sex cells were included that mirror the splits currently used in Medicare's current demographic adjustment methodology. For the purposes of calibrating the model, beneficiaries are assigned to more than one age cell if they aged into a new cell during 1996. For example, a beneficiary aged 69 on January 1, 1996 but who turned 70 years old later in 1996, is assigned to both the 65-69 and the 70-74 age cells as a fraction of eligible months in each cell. The value of the age/sex variable is the fraction of 12 months the person is in that cell. Payments for all months are thus set to the weighted average of the two payments and no change is necessary in the birthday month.

In the development of the final payment model, we also considered the inclusion of other

demographic variables. The purpose of including other demographic independent variables was to take into consideration the unique cost implications of characteristics not related to admissions, and to increase the accuracy of the payment estimates for subgroups of the Medicare population. The additional independent variables considered for inclusion were:

- Originally disabled;
- Medicaid status;
- Institutional status; and
- Working aged.

Treatment of each of these variables in the final model will be discussed separately.

Originally disabled: A beneficiary is defined as originally disabled if he is currently entitled to Medicare as an aged beneficiary, but was originally entitled by reason of disability. The other variables are currently used in Medicare's demographic adjustment methodology, although not necessarily in the way proposed here.

Preliminary analyses showed that Medicare expenditures for beneficiaries who were originally disabled or Medicaid enrolled were substantially higher than predicted by age, sex, and principal hospital diagnoses. Data on these characteristics for beneficiaries are available in HCFA administrative files. Analyses showed that if these factors were not taken into consideration in the calibration, the model would not predict the average expenditures of several important, and higher-cost, Medicare subgroups.

In the demographic model currently used by Medicare, originally disabled is not a risk factor. Rather, a separate rate book has applied to the currently disabled population. However,

we reasoned that the originally disabled may have higher Medicare expenditures than those who were not "originally disabled" (i.e., the elderly who were never entitled by reason of disability). Versions of the PIP-DCG model which did not include factors accounting for original reason for entitlement would call for a payment reduction when a disabled 64 year-old became classified as aged at age 65 because the disabled beneficaries would be averaged in with healthier 65 year olds.

In the payment model, the originally-disabled payment varies by age/sex group and is in addition to the regular age/sex payment. This means that for a given age/sex cell, predicted costs vary between those who were originally disabled and those who were not originally disabled. Alternatively, it allows for the possibility that the trajectory of expected costs as beneficiaries age could differ between the originally disabled and those not originally disabled.

Medicaid eligibility: Currently, Medicaid status is a concurrent adjustment factor for Medicare capitation payments. That is, a Medicare beneficiary is placed into an AAPCC "rate cell" payment category each month based on his or her current Medicaid enrollment status. For the purposes of risk adjustment, we defined Medicaid status as enrollment in Medicaid in any single month during the data collection year (e.g., all or part of 1995). Thus, in the risk adjustment system, beneficiaries who are Medicaid-eligible at any time during the data collection year will be eligible for the Medicaid payment increment for the entire following year; payments will no longer vary according to month-to-month Medicaid eligibility in the payment year. This add-on payment varies by age/sex group.

Institutional status: Another independent variable considered for inclusion was institutional status. We received a number of comments regarding the inclusion of an institutional adjustment; because of this level of interest, our analysis of the issue will be presented in some detail. Institutional status is currently used in the AAPCC methodology as a concurrent risk adjuster. For each prior month in a certified institution, a beneficiary is paid at the higher institution rate cell amount the following month. It is included as a marker for higher expected concurrent cost. The concern expressed by the commenters is that we will be underpaying for these beneficiaries if we do not make a similar concurrent adjustment in the new system.

In analyzing this issue for the purpose of risk adjustment, we also defined institutional status concurrently, as the fraction of the prediction year institutionalized, i.e., the number of institutional months in the prediction year divided by the number of Medicare eligible months. Because it is very difficult to identify long-term institutional care in claims data, the effect of institutional status was estimated using three concatenated years of the Medicare Current Beneficiary Survey (MCBS), from 1992 to 1994. Using the current definition of the institutionalized, we found that the model accurately predicted average actual costs, i.e. there was no reason for a separate institutionalized factor.

There is, however, great variation in Medicare costs for institutionalized beneficiaries across types of institutions. Certified institutions under HCFA's definition include both post-acute and long-term care facilities. Post-acute care facilities include Skilled Nursing Facilities (SNFs). Long-term care facilities include nursing homes, mental health facilities, and Intermediate Care

Facilities for the Mentally Retarded (ICF/MRs). Three quarters of the institutionalized are in nursing homes. Half of the remainder are in SNFs or the SNF/nursing home combination. About 7 percent are in ICF/MRs, and 3 percent are in mental health facilities.

Our analysis using MCBS data showed that mean actual Medicare payments for those in post-acute care facilities are far greater than those for long-term care facilities. In Medicare, a SNF stay requires a preceding hospital stay. The payment system is designed to pay premiums that are correct on the average for groups of enrollees. It does not pay based on actual events in the payment year. If we did so, we would also recoup payments for those who incur very low costs in the payment year. Thus we do not pay more for the particular group that spend some time in a SNF. Those in long term care facilities incur relatively low costs. An institutional factor for this population would actually be negative if implemented. The incentives for identifying the long term institutionalized and reporting on this group are low when the result is a payment reduction. We have therefore decided not to pay based on this site of service. There are relatively few enrollees in this group and the overpayments will be small.

PIP-DCG Payment Model

To estimate the final coefficients of the PIP-DCG calibration model, HCFA regressed annualized 1996 expenditures on the 15 PIP-DCGs, age/sex groups, originally disabled status, and Medicaid status. The model is specified so that there is a separate variable for each age/sex group. To this there is an additional vector of age/sex variables for those who were originally

disabled, and a vector of age/sex variables for those who were Medicaid enrollees. The final PIP-DCG payment model is shown in Table 2.2.

The regression yields payment estimates based upon fee for service data. It is important to note that these payments are not the payments that will be made to the M+C plans. Payment under the Medicare system will be based upon county rates (as published in the Medicare+Choice rate book) as mandated by BBA. These payment amounts estimated here will be converted into relative risk factors, which in turn modify the appropriate county rate according to the characteristics of the individual Medicare+Choice enrollee. The following discussion pertaining to predicted payments is, therefore, for purposes of illustration.

Increased payments for PIP-DCG categories: The coefficients for PIP-DCGS 5 through 29 show the *marginal* expenditure/payment for a person with a 1995 principal in-patient diagnosis placing them in that PIP-DCG (see Table 2.2). For example, a 73 year old woman with a single 1995 admission diagnosis of 'Precerebral Arterial Occlusion' is in PIP-DCG 8, implying an annualized 1996 payment of $2,998 (age/sex coefficient) + $4,192 (PIP-DCG 8 coefficient) = $7,190.

Higher numbered PIP-DCGs yield higher payments. Altogether, persons in PIP-DCGS 5 through 29 comprise approximately 12 percent of the sample, and 68 percent of sample persons hospitalized in 1995. In other words, the payment PIP-DCG model uses principal hospital diagnoses to risk adjust payments for about 12 percent of all Medicare beneficiaries; the other 88

percent are risk adjusted only by age, sex, and other demographics, much as they are under the current system. Of those hospitalized, 68 percent receive increases in payments in the following year.

Medical education: For the purposes of estimating the final payment factors, it would have been ideal to exclude all Graduate Medical Education (GME) payments (i.e., both indirect and direct medical payments) to hospitals from the 1996 expenditure amounts, but it was not possible to do so. The BBA specifies that GME amounts are to be "carved out" of capitation payments to Medicare+Choice plans (over a period of 5 years, with full carve out achieved in 2002), and paid directly to teaching hospitals. Through a relatively simple algorithm, it was possible to remove the indirect medical payments, which reflect about two-thirds of total GME payments. Though a portion of GME therefore remained in the costs used for model calibration, there is little effect on payments. It is important to note that the PIP-DCG model is used to compute relative factors only. GME payments will be removed from the rate book amounts in accordance with the requirements of the BBA.

Decedents: To correctly estimate monthly payments for all beneficiaries, including people who died or entered a hospice during 1996, we used a process of weighting by Medicare eligible months in the prediction year. First, annualized 1996 payments were calculated as actual total 1996 payments divided by the fraction of the year each beneficiary is alive or not enrolled in a hospice. This yielded an average annual cost, which is 12 times the average monthly cost. These annualized payments were then weighted in the regression by the fraction of the year the

beneficiary was eligible for Medicare. This process avoids the dilution of costs typically associated with decedents in their last months of life. The process of annualizing and weighting observations resulted in unbiased estimates of the average and total payments for a group in which individuals are eligible for different fractions of the year.

Data collection and time lags: The final payment model was calibrated assuming no time lag between the data collection period (using diagnoses collected between January 1, 1995 through December 31, 1995) and the predicted payment year (beginning January 1, 1996). While this approach results in model coefficients with the maximum predictive accuracy, it also introduced difficult operational issues; under this approach, retroactive payment adjustments would be necessary because encounter records would still be flowing in for some months during the payment year.

An alternative approach proposed in the Sepetmber 8, 1998 Federal Register notice, called the "time shifted" model, uses data from an earlier period (for example, July 1, 1998 through June 30, 1999) to determine the risk factor for enrollees and payments to Medicare+Choice organizations for calendar year 2000. However, calibration of the model continues to assume no data lag. Using data from an earlier time period introduces some error into the estimates, but we do not believe it introduces any systematic bias. Assuming a relatively large and stable population for a plan, aggregate payments under this approach are not likely to differ from aggregate payments using a method requiring retroactive payment adjustment. On an individual basis, using data from an earlier time period lengthens the time between a hospital stay for an enrollee and

compensation to the organization based on the stay, but also continues the higher payment beyond the time it would be paid in a non-shifted system.

In the September 8, 1998 Federal Register notice, HCFA asked plans to comment on: (1) problems Medicare+Choice organizations might encounter with retroactive payment adjustments, and (2) if data from an earlier time period were used, what problems are organizations likely to encounter? Comments received on the notice almost unanimously favored the second approach. The commenters specifically mentioned the following concerns:

- Medicare+Choice organizations believe that both plans and their providers would find it easier to understand and administer financial interactions if individual risk scores were known before the start of the contract year.

- Retroactive adjustments would increase payment uncertainty for Medicare+Choice organizations. In particular, Medicare+Choice organizations would not know their final per enrollee payments for a year until several months after the ACR for the following year was filed. In addition, providers with percentage-of-premium contracts could experience mid-year adjustments that could require changes to reimbursements for individual providers.

- Implementation of retroactive adjustments would also require additional changes to HCFA's payment systems which would not be required under the alternative. Such changes would not be easy to accomplish in the current implementation schedule.

HCFA agreed with the commenters who recommended that we not adopt the retroactive model at this time; the increased administrative burdens and greater uncertainty about payment levels render this option unacceptable for the present. Moreover, HCFA does not believe that implementation of this option, using the current PIP-DCG model, would create any systematic bias at the level of the aggregate payment to a plan.

Technical refinements to the calibrated model

Before HCFA finalized this estimated model into a payment system, a number of technical refinements were incorporated, including the development of factors for two sub-populations not addressed in the calibration of the model: the working aged and the newly entitled.

Working Aged Adjustment: The PIP-DCG model was calibrated using Medicare beneficiaries not covered by employer or other group policies. For beneficiaries with employer insurance, Medicare is the secondary payor and its liability is much smaller than for those who are not working. The model for the non-working aged was used to predict payments for the working aged. A regression analysis was run to determine the correction factor needed. Iit was estimated that, on the average, Medicare's liability for the working-aged in fee-for-service is 21 percent of those for whom Medicare is the primary payer. Therefore, payments made to beneficiaries in this status were reduced to 21 percent of what they would have been.

Demographic-only factors for new enrollees: As described earlier, the model was calibrated using only beneficiaries for whom Medicare data existed in 1995 and 1996. One implication of this model is that it requires diagnoses in the year before payment is made. Therefore, the model cannot predict expenditures for beneficiaries for whom Medicare does not have diagnosis data. The Medicare program cannot compile diagnosis data on beneficiaries for the year before they enter the program. Thus, no prior diagnosis information exists for the new disabled beneficiaries and age-in beneficiaries. Predicted expected cost estimates were derived for

these beneficiaries using only demographic factors.

Two similar, but different methods were used to predict expenditure estimates for the age-ins in the 65-69 age groups and other new eligibles. Those age 70 and above, and those under 65, were assigned the mean predicted expenditure for beneficiaries with the same age/sex/Medicaid status. For the age-ins between age 65 and 69, a different procedure was used because the mean predicted value for the age bracket was based mainly on persons 67-69 years old in 1996. Actual expenditures in 1996 for persons 67-79 years old were computed and used in a regression to predict the missing age groups. For all new enrollees, payments based on Medicaid eligibility will be made retroactively, once enrollment can be established and verified.

Actuarial graduation of the final payment model factors: HCFA's Office of the Actuary revised the age/sex demographic coefficients. Upon review, the age/sex coefficients for the originally disabled, and Medicaid recipients were found to be somewhat irregular in pattern. This pattern, if uncorrected, would have led to irregular changes in payments as beneficiaries in these groups aged. Therefore, these coefficients were refined by HCFA actuaries so that the predicted payment patterns across age groups within each of those categories was smoothed. Several generally accepted actuarial techniques were used to smooth each set of factors. The actuarial techniques used were graduation, regression, interpolation, and judgement. The type of graduation used was Whittaker-Henderson which smoothed the raw payment amounts using a minimization formula based on a linear combination of fit versus smoothness. The fit part of the expression is the summation of the squared differences between the raw data and the smoothed

data. The smoothness part of the expression is the summation of squared third differences which approximates a quadratic function. Each of the fit and smoothness component of the formula is minimized simultaneously. Also, the graduation uses weights for each age group and the weights represent the number of Medicare beneficiaries in each cell.

Further detail on the PIP-DCG payment model: Two additional sources of information are available on the final PIP-DCG payment model. Located on HCFA's external Web sit (http://www.hcfa.gov/stats/hmorates/aapccg.htm) are: (1) basic SAS software for the PIP-DCG grouper, and (2) a detailed text file of the mapping of ICD-9-CM codes to DxGroups, and finally to PIP-DCGs. These files are made available for information purposes, but are subject to minor modifications prior to the final payment notice to be issued on March 1, 1999.

Proposed Payment System Application of the PIP-DCG Model

In its basic form, the PIP-DCG model is an algorithm that uses base year inpatient diagnoses, along with demographic factors, to predict total health spending in the following year. In applying the PIP-DCG model to risk adjust payments for the Medicare+Choice program, however, the model will be used to determine relative risk factors. To derive the relative risk factors, predicted expenditure estimates from the model are divided by the mean predicted expenditures for FFS beneficiaries. Currently, we estimate this mean to be $5100, though final refinements to this figure are possible prior to the final payment notice on March 1, 1999. Because the predicted expenditures are used in the form of relative ratios, applied to the rate

book, payments are not sensitive to the year of the expenditure data used in the calibration. These relative risk factors will be used, in place of the current demographic factors, to adjust county rate book amounts for the relative health status of the individual enrollee.

Estimating Beneficiary Relative Risk Factors: The PIP-DCG model was developed to be "additive", meaning that incremental dollars are added based on beneficiary characteristics. Referring to Table 2, the following examples illustrate how the PIP-DCG model will be used for estimating relative risk factors.

Examples: In this example, Beneficiary A was hospitalized twice during the base year. The diagnoses reported were Asthma (PIP-DCG 8) and Staphylococcus Pneumonia (PIP-DCG 18). The highest PIP-DCG category then for this beneficiary is PIP-DCG 18, which carries with it an estimated future year expenditure of $13,547. The beneficiary is also placed in the appropriate demographic group. In this case, Beneficiary A is male, aged 82. This age group carries an estimated expenditure of $5,495. In addition, Beneficiary A had originally been Medicare eligible because of a disability (which carries an incremental expenditure of $1,462), but is not eligible for Medicaid (no expenditure increment). Adding together these increments based on the PIP-DCG model, the predicted expenditures for this beneficiary are $20,504.

Beneficiary B had no inpatient admissions during the base year. Therefore, no specific PIP-DCG increment is added; expenditures for non-hospitalized beneficiaries are included in the demographic factors. Beneficiary B is placed in the appropriate age and sex grouping; in this

case, female, aged 69, which carries a predicted expenditure of $2,310. Beneficiary B is also placed in the Aged with Medicaid eligibility group, which adds $2,207 to her annual predicted expenditures. Since she has never been disabled, no additional expenditures are added. Therefore, total annual predicted expenditures for Beneficiary B are $4,517.

Because Medicare+Choice program payments are based on the county-wide rates determined under section 1853(c)of the Act, the predicted annual expenditures described above will be converted to relative risk factors. This is accomplished by dividing the predicted expenditures for each beneficiary by the national average predicted expenditure (currently estimated at $5,100). Individuals whose risk factors are equal to 1.00 are "average." In the examples described above, Beneficiary A's relative risk factor is 4.02 (indicating a high expected cost individual), while Beneficiary B's relative risk factor is 0.89 (indicating a slightly lower than average risk individual).

Assignment of risk factors: After Medicare+Choice organizations submit inpatient hospital encounter data, we will use the demographic information and diagnostic information from all Medicare+Choice organizations a beneficiary may have joined and from FFS to determine the appropriate risk factor for each beneficiary. It is at this point that information regarding beneficiary Medicaid eligibility (in any single month during the diagnosis data collection year), original reason for Medicare entitlement (originally disabled) for any one month, identification as a new enrollee, beneficiary age, sex and working-aged status (beneficiary covered under a employer insurance) are determined using Medicare administrative data files, and are used along

with inpatient diagnostic data to assign the appropriate risk factor.

When a Medicare+Choice organization forwards beneficiary enrollment information to HCFA, we, in turn, will send the organization the appropriate risk factor for the beneficiary, as well as the resultant payment. Because the risk factor is *computed for each individual beneficiary,* the factor follows that beneficiary. In addition, since all beneficiaries will have risk factors, information will be immediately available for payment purposes as beneficiaries move among Medicare+Choice organizations.

Predicted Ratios: To determine how well the PIP-DCG predicts average Medicare payments for beneficiaries hospitalized for various diagnoses, and for other characteristics, the researchers computed mean predicted expenditures, mean actual expenditures, and their ratio (predictive ratio = mean predicted expenditures/mean actual expenditures) for each PIP-DxGroup. The results are shown in Tables 2.3. These predictive ratios should be interpreted cautiously, for two reasons. First, several of the PIP-DxGroups, especially some of the highest-cost ones, have small sample sizes and hence their actual mean expenditures are not estimated very precisely. Predictive ratios for them are very approximate. Second, the predictive ratios are calculated on the same sample used to estimate the models, not an independent validation sample. This introduces the possibility of over fitting, biasing the predictive ratios to look better (closer to one) than they actually are.

Most of the predictive ratios are less than one. This occurs because the PIP-DCG model

predicts expenditures using only a person's single highest-cost admission. The most expensive cases are probably disproportionately likely to be hospitalized multiple times, even in the base year. A single million dollar case who is hospitalized five times in the base year could appear in five different PIP-DxGroups. Since the greatest prediction possible in the PIP-DCG payment model is $36,759 (for a 95+ year old male in PIP-DCG 29), this single case could, depending on sample sizes, cause predicted expenditures to fall well short of actual expenditures in five different PIP-DxGroups. Despite this, it is important to note the relative improvement in predictive ratios between the Age-Gender (i.e. AAPCC-like) only model and the PIP-DCG model. In all cases, predictive ratios improve substantially (move closer to 1.00) under the PIP-DCG model.

This important trend is found both in sub-groups for which the Age-Gender model overpredicted expenditures, and for groups which were underpredicted using only Age-Gender. For example, under the Age-Gender model, the predictive ratio for the group of beneficiaries with expenditures in the first quintile (lowest) was 2.66, indicating overpredicted expenditures of 2.66 times actual expenditures. Under the PIP-DCG model, the predictive ratio for this group drops to 2.09; while an overprediction still occurs, it is reduced substantially. On the other hand, the Age-Gender model underpredicted expenditures for beneficiaries with chronic conditions; for this group, the predictive ratio was 0.83 using the Age-Gender model. Under the PIP-DCG model, the predictive ratio for individuals with chronic illness rises to 0.89; the improvement for some specific chronic illnesses are more dramatic.

In the payment model, the predictive ratio for individuals with no admissions (the base

year) is 1.07; it exceeds unity. This occurs because of the decision to place individuals with one-day stays into this base group. Because one-third of beneficiaries admitted are grouped with those not admitted in estimating payment weights, payments are over predicted by 7 percent for those not admitted. This misprediction is part of the price that is paid in predictive accuracy for improving payment incentives.

Table 2.1: Diagnoses (DxGroups) Included in Each PIP-DCG – Payment Model

PIP-DCG 5		
DxGroup	14	Breast Cancer (b)
	131	Ongoing Pregnancy with Complications
	132	Ongoing Pregnancy with No or Minor Complications
PIP-DCG 6		
DxGroup	18	Cancer of Prostate/Testis/Male Genital Organs (b)
PIP-DCG 7		
DxGroup	1	Central Nervous System Infections
	39	Abdominal Hernia, Complicated
	64	Alcohol/Drug Dependence
PIP-DCG 8		
DxGroup	16	Cancer of Uterus/Cervix/Female Genital Organs (b)
	36	Peptic Ulcer
	77	Valvular and Rheumatic Heart Disease
	79	Hypertension, Complicated
	80	Coronary Atherosclerosis
	84	Angina Pectoris
	86	Atrial Arrhythmia
	92	Precerebral Arterial Occlusion
	96	Aortic and Other Arterial Aneurysm
	110	Asthma
	153	Brain Injury
	158	Artificial Opening of Gastrointestinal Tract Status
PIP-DCG 9		
DxGroup	21	Other Cancers (b)
	32	Pancreatitis/Other Pancreatic Disorders
	82	Acute Myocardial Infarction
	94	Transient Cerebral Ischemia
	145	Fractures of Skull and Face
	146	Pelvic Fracture
	147	Hip Fracture
	150	Internal Injuries/Traumatic Amputations/Third Degree Burns
PIP-DCG 10		
DxGroup	11	Colon Cancer (b)
	59	Schizophrenic Disorders
	81	Post-Myocardial Infarction
	83	Unstable Angina
	97	Thromboembolic Vascular Disease
	116	Kidney Infection
	143	Vertebral Fracture Without Spinal Cord Injury

PIP-DCG 11

DxGroup		
	42	Gastrointestinal Obstruction/Perforation
	45	Gastrointestinal Hemorrhage
	87	Paroxysmal Ventricular Tachycardia
	109	Bacterial Pneumonia
	133	Cellulitis and Bullous Skin Disorders

PIP-DCG 12

DxGroup	4	Tuberculosis
	10	Stomach, Small Bowel, Other Digestive Cancer
	12	Rectal Cancer
	19	Cancer of Bladder, Kidney, Urinary Organs
	22	Benign Brain/Nervous System Neoplasm
	26	Diabetes with Acute Complications/Hypoglycemic Coma
	41	Inflammatory Bowel Disease
	48	Rheumatoid Arthritis and Connective Tissue Disease
	49	Bone/Joint Infections/Necrosis
	56	Dementia
	57	Drug/Alcohol Psychoses
	60	Major Depression
	73	Epilepsy and Other Seizure Disorders
	91	Cerebral Hemorrhage
	93	Stroke
	98	Peripheral Vascular Disease
	111	Pulmonary Fibrosis and Bronchiectasis
	113	Pleural Effusion/Pneumothorax/Empyema

PIP-DCG 14

DxGroup	2	Septicemia/Shock
	29	Adrenal Gland, Metabolic Disorders
	58	Delirium/Hallucinations
	61	Paranoia and Other Psychoses
	63	Anxiety Disorders
	66	Personality Disorders
	70	Degenerative Neurologic Disorders
	144	Spinal Cord Injury

PIP-DCG 16

DxGroup	8	Mouth/Pharynx/Larynx/Other Respiratory Cancer
	13	Lung Cancer
	34	Cirrhosis, Other Liver Disorders
	89	Congestive Heart Failure
	95	Atherosclerosis of Major Vessel
	105	Chronic Obstructive Pulmonary Disease

PIP-DCG 18

DxGroup		
	17	Cancer of Placenta/Ovary/Uterine Adnexa
	55	Blood/Immune Disorders
	72	Paralytic and Other Neurologic Disorders
	75	Polyneuropathy
	108	Gram-Negative/Staphylococcus Pneumonia

PIP-DCG 20

DxGroup	27	Diabetes with Chronic Complications
	76	Coma and Encephalopathy
	112	Aspiration Pneumonia
	115	Renal Failure/Nephritis

PIP-DCG 23

DxGroup	9	Liver/Pancreas/Esophagus Cancer (b)
	33	End-stage Liver Disorders
	88	Cardio-Respiratory Failure and Shock
	134	Decubitus and Chronic Skin Ulcers

PIP-DCG 26

DxGroup	7	Metastatic Cancer (b)
	20	Brain/Nervous System Cancers (b)

PIP-DCG 29

DxGroup	3	HIV/AIDS (a)
	15	Blood, Lymphatic Cancers/Neoplasms (b)

Notes:

(a) Includes principal and secondary inpatient diagnoses of HIV/AIDs.

(b) Includes principal diagnoses and secondary diagnoses when the prinicpal diagnosis is chemotherapy.

Table 2.2
Payment Model
Beneficiaries Medicare Eligible at Least One Year

Variable	Age/Sex Coefficient	Medicaid Add-on	Originally Disabled Add-on	Disease Add-on	
Male:0-34	1,873	639		PIPDCG 5	1,910
Male:35-44	1,939	1,442		PIPDCG 6	2,333
Male:45-54	2,486	1,888		PIPDCG 7	3,556
Male:55-59	3,134	2,025		PIPDCG 8	4,192
Male:60-64	3,874	2,134		PIPDCG 9	4,666
Male:65-69	2,759	2,244	2,115	PIPDCG 10	5,969
Male:70-74	3,598	2,330	2,029	PIPDCG 11	6,480
Male:75-79	4,625	2,353	1,705	PIPDCG 12	8,474
Male:80-84	5,495	2,271	1,462	PIPDCG 14	10,200
Male:85-89	6,414	2,060	1,207	PIPDCG 16	12,435
Male:90-94	7,019	1,688	962	PIPDCG 18	13,547
Male95+	6,923	1,235	717	PIPDCG 20	17,298
Female:0-34	1,844	981		PIPDCG 23	19,496
Female:35-44	2,055	1,590		PIPDCG 26	22,313
Female:45-54	2,685	1,870		PIPDCG 29	26,464
Female:55-59	3,280	2,025			
Female:60-64	4,544	2,103			
Female:65-69	2,310	2,207	3,083		
Female:70-74	2,998	2,246	2,940		
Female:75-79	3,810	2,314	2,645		
Female80-84	4,683	2,156	2,119		
Female85-89	5,589	1,669	1,594		
Female:90-94	5,928	1,178	1,183		
Female:95+	5,754	855	773		

Table 2.2, cont.
Payment Model
New Beneficiaries

Variable	Coefficient	Medicaid Add-on
Male, 0-34	2,610	1,139
Male, 35-44	2,849	1,969
Male, 45-54	3,312	2,369
Male, 55-59	4,130	2,546
Male, 60-64	4,889	2,578
Male, 65	2,679	3,328
Male, 66	2,921	3,297
Male, 67	3,162	3,266
Male, 68	3,403	3,235
Male, 69	3,644	3,204
Male, 70-74	4,321	3,028
Male, 75-79	5,537	3,140
Male, 80-84	6,667	3,124
Male, 85-89	7,742	3,108
Male, 90-94	8,494	1,971
Male, 95+	8,505	1,806
Female, 0-34	2,730	1,330
Female, 34-44	2,955	2,157
Female, 45-54	3,550	2,173
Female, 55-59	4,284	2,762
Female, 60-64	5,662	2,298
Female, 65	2,276	3,076
Female, 66	2,468	3,075
Female, 67	2,660	3,074
Female, 68	2,852	3,073
Female, 69	3,044	3,072
Female, 70-74	3,587	2,945
Female, 75-79	4,587	3,030
Female, 80-84	5,664	3,003
Female, 85-89	6,771	2,162
Female, 90-94	7,290	1,670
Female, 95+	7,041	918

Table 2.3

Predictive Ratios[1] for Alternative Risk Adjustment Models, by Validation Subgroup, Five Percent Sample

		Model		
Validation Group	Number of Observations	Age-Gender[2]	Age-Gender + Medicaid and Ever Disabled[3]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[4]
Overall Sample	1,387,105	1.00	1.00	1.00
Age and Gender				
Female, 0-34	7,060	1.00	1.00	1.00
Female, 35-44	13,097	1.00	1.00	1.00
Female, 45-54	16,762	1.00	1.00	1.00
Female, 55-59	10,463	1.00	1.00	1.00
Female, 60-64	13,808	1.00	1.00	1.00
Female, 65-69	138,066	1.00	1.00	1.00
Female, 70-74	195,473	1.00	1.00	1.00
Female, 75-79	165,533	1.00	1.00	1.00
Female, 80-84	125,320	1.00	1.00	1.00
Female, 85-89	77,973	1.00	1.00	1.00
Female, 90-94	35,953	1.00	1.00	1.00
Female, 95+	12,837	1.00	1.00	1.00
Male, 0- 34	11,473	1.00	1.00	1.00
Male, 35-44	21,784	1.00	1.00	1.00
Male, 45-54	25,228	1.00	1.00	1.00
Male, 55-59	13,805	1.00	1.00	1.00
Male, 60-64	17,664	1.00	1.00	1.00
Male, 65-69	112,241	1.00	1.00	1.00
Male, 70-74	145,759	1.00	1.00	1.00
Male, 75-79	110,183	1.00	1.00	1.00
Male, 80-84	69,751	1.00	1.00	1.00
Male, 85-89	33,035	1.00	1.00	1.00
Male, 90-94	11,042	1.00	1.00	1.00
Male, 95+	2,793	1.00	1.00	1.00
Race				
Black	118,843	0.79	0.89	0.90
Non-Black	1,268,262	1.02	1.01	1.01
Medicare Entitlement Status				
Elderly	1,235,960	1.00	1.00	1.00
Disabled	151,145	1.00	1.00	1.00
Other Demographic Characteristics				
Medicare as Secondary Payer[5]	15,461	n/a	0.99	0.99
Ever Disabled	90,792	0.61	0.99	1.00
Medicaid Enrollee, Base Year	205,635	0.70	1.00	1.00
Expenditures, Base Year				
First Quintile (lowest)	277,413	2.66	2.57	2.09
Second Quintile	277,428	1.93	1.88	1.54
Middle Quintile	277,422	1.35	1.35	1.10
Fourth Quintile	277,421	0.95	0.96	0.84
Fifth Quintile (highest)	277,421	0.44	0.47	0.75
Top 5 Percent	69,356	0.27	0.29	0.61
Top 1 Percent	13,872	0.18	0.19	0.47
Hospital Admissions, Base Year				
No admissions	1,127,945	1.32	1.31	1.07
One admission	149,515	0.64	0.66	1.02
Two admissions	62,866	0.48	0.50	0.91
Three or more admissions	46,779	0.28	0.31	0.69

Table 2.3 (continued)
Predictive Ratios[1] for Alternative Risk Adjustment Models, by Validation Subgroup, Five Percent Sample

Validation Group	Number of Observations	Model Age-Gender[2]	Age-Gender + Medicaid and Ever Disabled[3]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[4]
Chronic Conditions[6]				
Any chronic condition below	958,305	0.83	0.84	0.89
Depression	62,889	0.55	0.59	0.77
Alcohol / Drug Dependence	10,945	0.40	0.44	0.78
Hypertensive Heart / Renal Disease	97,990	0.63	0.65	0.81
Benign / Unspecified Hypertension	558,223	0.82	0.83	0.90
Diabetes with Complications	57,675	0.44	0.47	0.63
Diabetes without Complications	194,852	0.60	0.63	0.73
Heart Failure / Cardiomyopathy	146,059	0.48	0.51	0.74
Acute Myocardial Infarction	26,573	0.45	0.47	0.78
Other Heart Disease	357,088	0.65	0.66	0.80
Chronic Obstructive Pulmonary Disease	234,004	0.60	0.63	0.79
Colorectal Cancer	16,945	0.59	0.59	0.78
Breast Cancer	28,688	0.77	0.75	0.81
Lung/Pancreas Cancer	10,907	0.35	0.35	0.61
Other Stroke	72,018	0.50	0.53	0.74
Intracerebral Hemorrhage	3,676	0.39	0.42	0.73
Hip Fracture	19,384	0.56	0.59	0.83
Arthritis	253,077	0.77	0.79	0.84

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[1] Mean predicted expenditures for a group divided by mean actual expenditures.

[2] Model 1 of Table 5-2, HER 1/99 Report.

[3] Model 2 of Table 5-2, HER 1/99 Report.

[4] Model in Table 8-6. Diagnoses from short stays excluded, HER 1/99 Report.

[5] 'Medicare as secondary payer' group was not calculated for Age-Gender model.

[6] Defined as persons with a 1995 diagnosis on a Medicare hospital inpatient, outpatient, physician, or other health professional claim.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 5% SAF.

CHAPTER 3: INTEGRATION OF THE PIP-DCG RISK FACTOR INTO THE MEDICARE+CHOICE PAYMENT SYSTEM

While the PIP-DCG methodology is used to assign relative risk scores to beneficiaries, these risk scores are only one part of the risk adjusted payment model. This chapter will describe the Medicare+Choice payment system as it is currently, the issues related to substituting PIP-DCG risk scores for the current demographic factors in the payment formula, and HCFA's proposed method for making risk adjusted Medicare+Choice payments.

Capitated Medicare Managed Care Payments: Adjusted Average Per Capita Costs

Since the inception of the Medicare managed care program, capitated payments to plans care have been set using an Average Adjusted Per Capita Cost (AAPCC) methodology. The logic of this approach was to base capitated payments on average costs found in fee for service. Because it was assumed that expenditures for enrollees in managed care would be lower, the Medicare estimated fee-for-service costs are discounted by 5 percent. In order to account for local differences in the health needs of beneficiaries, and related differences in spending, these average costs are estimated at the county level, and standardized according to the average demographics observed for beneficiaries in that county. Thus, the basic components of the AAPCC include average fee-for-service costs in the county and an average county demographic factor score. These county AAPCC figures have been expressed in an annual county rate book, which is the basis for all managed care payments for Medicare enrollees.

While the county rate book is the basis for payments, final Medicare capitated payments

are also risk adjusted according to the actual demographic profile of each enrollee. The demographic factors used as part of the county rate book calculation were the same factors used to adjust final payment amounts for the demographic characteristics of individual enrollees: age, sex, institutional status, and eligibility for Medicaid. This payment methodology can be best summarized by this (simplified) formula:

Payment = (0.95) x(County Per Capita Costs/Avg. County Demographic Score)x Enrollee Demographic Score

Or, in even more simplified terms:

Payment = (AAPCC County Rate Book) x Enrollee Demographic Score

It is the 1997 version of this AAPCC county rate book that is, by law, the basis of Medicare capitated payments under BBA.

Rate book changes under BBA: The BBA requirements for the Medicare+Choice payment system modified the former way of computing the capitated rate book. This was done to meet a number of policy objectives, including a desire to create a minimum rate for traditionally low rate counties, and a flattening of the variability of county rates by basing these rates in part on local factors, and in part by national experience. While somewhat complex, it is important to understand how the Medicare+Choice rate book is calculated, as it affects implementation of risk adjustment.

Blended rates: Every year after 1997, the Medicare+Choice rates (together making up the "rate book") for each county are defined as the maximum of three possible categories: the blended capitation rate, minimum "floor" amount, **or** minimum 2 % increase. Of the three options, the blended capitation rate in any given county is by far the most complex, and is defined as:

county blended capitation rate = (area%factor* local county capitation rate,) + (national% factor*national capitation rate)

The area percentage factors for Parts A and B are specified in BBA and are equal to: 90% in 1998; 82% in 1999; 74% in 2000; 66% in 2001; 58% in 2002; 50% in 2003 and after. The national factors for each year are also specified in BBA, and are equal to 100% minus the appropriate area percentage factor.

The local county capitation rate, under BBA, is a function of the 1997 AAPCC county rate book amount for Medicare Parts A and B, multiplied by the United States Per Capita Cost (USPCC) growth percentage increase for Parts A and B. BBA also specifically defines the National Per Capita Medicare+Choice growth Percentage as the actual USPCC growth rate for Medicare Parts A and B growth minus .8 percentage points in 1998, minus .5 percentage points in 1999 through 2002, and actual USPCC Parts A and B growth after the year 2002. In addition, BBA mandates that graduate medical education costs be carved out of the 1997 county rates (20 percent in 1998, 40 percent in 1999, 60 percent in 2000, 80 percent in 2001, and 100 percent thereafter).

Both the local county and national capitation rates are also defined in BBA. The local county capitation rates, beginning in 1998 are calculated as the 1997 AAPCC County Rate Book amount for Parts A and B, multiplied by the national per capita Medicare+Choice growth percentage increase for Parts A and B. Finally, the last piece of the formula is the national capitation rate, which is in turn a function of the national *standardized* capitation rate (calculated separately for Parts A and B). The national *standardized* capitation rate is equal to:

Sum over all counties of: (local A, B capitation rates for the county$_{(I)}$) *
(number of ALL beneficiaries in the county$_{(I)}$)*
(average ALL beneficiary risk adjustment factor weights)

Divided by:

Sum over all counties of: (number of ALL beneficiaries in the county$_{(I)}$)*
(average risk factor weights for ALL beneficiaries in the county)

This component of the rate book calculation is where the local per capita costs are standardized according to the relative risk factor of beneficiaries in that county, relative to the national risk factor mean. Prior to BBA, this risk factor standardization was accomplished using average demographic risk factors. Once risk adjustment is implemented, this standardization should be revised to reflect health status risk factors. This point will be discussed in more detail later in this chapter when the process of restandardization and rescaling is described.

Continuing to define the components of the county rate amounts, the national capitation rate is equal to:

Sum of: ((national standardized cap rate for Parts A) * (actuarial weight for Part A)* (Relative Prices for Part A)) + ((national standardized capitation rate for Part B) * (actuarial weight for Part B)* (Relative Prices for Part B))

Technically, county capitation rates are in large part calculated separately for Parts A and B, resulting in two rate books. When capitation rates are generally discussed for policy purposes, however, the Parts A and B rates are combined.

Floor amounts: The second possible category determining a county's capitation rate under Medicare+Choice is the minimum floor amount. In 1998, BBA specified this floor amount as $367. For 1999 and beyond, the $367 amount is trended forward using the national per capita Medicare+Choice growth percentage. In 1999, the minimum floor county rate is $379. This figure is then split between Parts A and B using national actuarial weights.

Guaranteed 2 percent: The third and final possible category determining a county's capitated rate is the minimum 2 percent increase. This increase is defined in BBA as 1.02 multiplied by the 1997 AAPCC County Rate Book Amount in 1998, then beginning in 1999, 1.02 multiplied by the Medicare +Choice county capitation rate used for payments in the prior year. This means that in 1999, county rate book amounts in all counties were guaranteed an increase of 2 percent over the rates in effect the prior year, regardless of the fact that graduate medical education is being removed from the cost rates and paid separately to teaching hospitals. It is also important to note that BBA does not allow corrections to the rate for previous errors in

projecting the USPCC growth rates.

Two additional thoughts are important regarding the 2 percent increase category. First, this increase relates to the county rates, and not to either aggregate or per enrollee payments to plans; payments are a function of the county rates and the risk factor scores assigned to each enrolled beneficiary. Therefore, plan payments can be higher or lower than 2 percent over the prior year, depending on the population enrolled. Second, the requirement that the 2 percent be applied relative to rates in effect the prior year becomes important in understanding the need for a rescaling factor, as will be explained later in this chapter.

Once Medicare+Choice county capitation rates have been determined by the largest of either the blended capitation rate method, minimum "floor", or minimum 2 percent increase method, other rules apply in the final calculation of the Medicare+Choice rate book. First, a "budget neutrality" factor is applied. Under this budget neutrality calculation, aggregate national estimated payments resulting from the combination of blends, floors, and minimum increases must be equal to (or less than) aggregate national Part A and B estimated payments under USPCC trended 1997 AAPCC rate book payments. If the blended/floor/minimum increase rates are not at or below this level, (theoretically) rates are reduced for blend counties to attempt to attain budget neutrality. In 1998 and 1999, this resulted in all counties being either at the floor or the minimum increase without budget neutrality being achieved.

The Need for Rate Book Restandardization and Rescaling

The essential purpose of the implementation of risk adjustment is the *substitution* of individual enrollee demographic factors with a new individual enrollee risk adjustment methodology. But this substitution should take place in *two* places: in the standardization of county rates, and in the method of estimating relative risk of individual enrollees. BBA modifications to the rate book make a direct rate book standardization substitution difficult because the 1997 demographic AAPCC rates are the basis for future rate books.

Demographic standardization: The old (demographically-based) AAPCC rate book represented the cost to Medicare in a given county for the national average beneficiary measured demographically. County rates were calculated by dividing county per capita costs by county average demographic factors. Prior to BBA, these rates were updated annually. However, because of BBA modifications, all Medicare+Choice county rates have their basis in the 1997 AAPCC Rate Book. Thus, the factors used in calculating this 1997 Rate Book are "locked in" – including the average county demographic factors. Also, the 2 percent minimum increase must be based on the prior year's rates used for payment.

Risk factor standardization: Despite these policy complications, it is important to apply the new enrollee risk adjustment methods to an appropriately standardized rate book. This is the case because, if we were to shift from an enrollee *demographic* factor to *risk-based* adjustments, while maintaining the factors underlying the current rate book, a critical inconsistency would be

created in the overall payment methodology. The risk adjustment methodology adds disease information to purely demographic information. Though attempting to measure the same thing -- relative health status -- the range of factors for the demographic-only and risk factors differs. This is in part simply because the measurement range (or "ruler") of risk factors exceeds that of the old demographic-only factors, and because the new risk factors are able to distinguish differences in health status more accurately. However, because the "rulers" differ between demographic and risk factors, a technical modification is necessary for payments to remain methodologically correct. Without some adjustment, this inconsistency between the standardization factors used in the county rates and the enrollee risk factors will result haphazardly in either significant underpayments or overpayments, depending on the county.

Example: The best way to illustrate the problem is through the following hypothetical example. Assume that, under the old AAPCC methodology, the average county demographic factor for county A was 1.0, indicating that, based on demographic factors, Medicare beneficiaries in "A" were at the national average. However, under the new risk adjustment methodology to be implemented under BBA, the average risk factor for county "A" is 1.3, indicating under this new measurement system that "A" county Medicare beneficiaries are "sicker" than the national average. In both cases, the same population is being measured during the same year – it's just that the "rulers" are different.

This difference in rulers -- left uncorrected -- would result in erroneous payments in the following way. Consider a Medicare beneficiary living in county "A" who has a number of health

problems, but whose risk factor is the same as the county average (1.3). Without any correction, the risk adjusted payment system will pay 1.3 times the rate book amount. Assuming monthly per capita costs in county A were $600, the demographic rate book amount would be $600 divided by 1.0 (the average demographic factor in county A), or $600. In other words, under the current system, beneficiaries with demographic factors equal to the county average would be paid $600. Payments under risk adjustment, however, would be 1.3 times $600, or $780. If the rate book were recomputed according to the average risk factor in the county (1.3), the rate would be $600 divided by 1.3, or $462. Payment for this average individual would then be $462 times 1.3, or $600. This is the correct amount for the average person in county A.

Potential underpayment for some beneficiaries would also occur in the absence of rescaling. For example, assume that the average county demographic factor in hypothetical county "B" is 1.1, or just slightly above the national average. Assume as well that the average county risk factor is estimated at 0.9, indicating a slightly healthier than average beneficiary population compared to the national average. For a Medicare beneficiary residing in county "B," who is equal to the county average of 0.9, a significant underpayment would result. Assuming per capita costs of $500, the demographic rate book would be $500 divided by 1.1, or $455. Risk adjusted payment for the average person would be .9 times $455, or $410. This is significantly less than the $500 that would be appropriate for the average person in county "B." If the rate book were appropriately rescaled, the rate book amount would be $500 divided by .9, or $556. A beneficiary with the average county risk factor of .9 would therefore receive a risk adjusted payment of .9 times $556, or $500.

Use of a rescaling factor: The most direct and accurate way to fix this problem would be to calculate both the average county and individual enrollee factors on the same scale – as originally done when both were calculated using demographic factors. Unfortunately, this is not possible since the rate book (including the demographic basis for the average county factor) is set by law. However, a "county rescaling factor," which is part of the risk adjustment methodology, places both the county and enrollee factors back on a comparable scale. The rescaling factor for each county will be defined as the ratio of the following:

$$\text{County Rescaling Factor} = \frac{\text{(Risk County Rate)}}{\text{(Demographic County Rate)}}$$

The denominator of this ratio (the demographic county rate) is simply the county rate calculated under the current system. The numerator (risk county rate) is the county rate properly standardized to the new risk adjustment factors. The calculation of these restandardized rates, resulting in risk-based county rates, require a number of steps. The process described here is somewhat simplified, though it provide sufficient understanding for the purpose of explaining the county rescaling factor.

Method for calculating county rescaling factors: First, average county risk factors (using the payment PIP-DCG model, and computed for each county for years 1994, 1995 and 1996, based on 100 percent Medicare FFS data) were developed. The average county risk factors replace the average county demographic factors found in the AAPCC rate book. The

average county risk scores were calculated from the 1994, 1995, and 1996 data, except for counties with small numbers of Medicare beneficiaries where adjustments were made. HCFA's Office of the Actuary (OACT) calculated combined Aged, Disabled, Parts A and B per capita costs for 1997. These combined county costs were standardized by the average county risk factors, making new local restandardized rates. From these new local rates, OACT applied the mandated calculations (e.g. blends/floors,/2 percent increase, budget neutrality, medical education carve outs, etc), consistent with BBA requirements. This process will be used to create a risk rate book, which could be used (in the numerator in the rescaling factor) to determine payments beginning in 2000.[4]

There will technically be two rescaling factors for each county: one to rescale payments for aged enrollees, and the other for disabled enrollees. For example, in a given county, the rescaling factor used in payments for an aged beneficiary is defined as:

$$\frac{\text{(Risk County Rate)}}{\text{(Aged Demographic County Rate)}}$$

For disabled beneficiaries, the ratio is:

$$\frac{\text{(Risk County Rate)}}{\text{(Disabled Demographic County Rate)}}$$

What differs in each case is only the denominator. Additional information on average county

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[4] It is important to note that, because of the blend transition policy, payments in 2000 will be based in part on the risk rate book and in part on the demographic rate book.

risk factors is available at HCFA's Web site (http://www.hcfa.gov). A file containing estimated county risk factors for the purpose of creating a 1997 risk rate book is posted on the Web site. However, minor revisions to the average county risk factors are possible prior to the annual announcement of payment rates on March 1, 1999.

Payment system application: Risk adjusted payment amounts for enrollees will thus be calculated as follows:

Payment = Demographic County Rate *
[(Risk County Rate)/(Demographic County Rate)] *
Enrollee Risk Factor

This approach preserves BBA requirements while assuring that payments are a function of the enrollee risk factor and the appropriately scaled risk rate book. Preserving the demographic rate book also facilitates implementation of a transition payment system that phases in the new system in stages.

Phase-in of risk adjusted payments

HCFA has determined that a the risk adjusted payment system will be phased-in, rather than allowed to take full effect on January 1, 2000. HCFA is proposing a policy of only partially phasing in the PIP-DCG system (for example, 80 percent of effect phased in by year 4) before moving to a full encounter system, as a way of moderating concerns about the bias of a inpatient-only model and the "exclusion" of 1 day stays. At that point, a "full" risk adjustment model (or potentially a new phase-in) would begin.

There is substantial precedent in the Medicare program for phasing in significant changes in payment methodology which could have adverse impacts on providers and beneficiaries. Among these precedents are:

- The 1983 statute establishing a prospective payment system for inpatient hospital operating costs provided for a three-year phase in, employing two simultaneous blends. There was an overall blend of decreasing hospital-specific and increasing federal rates. Within the federal rate, there was also a blend of decreasing national and increasing regional components. This transition was later extended to four years by statute. The transition ended in 1987, and hospitals have been under a fully rate-based system for their operating costs since 1988.

- In implementing a statutory requirement to establish a prospective payment system for inpatient hospital capital costs, the agency used its discretion to provide for a ten-year transition. This transition system employs a complicated array of grandfathering cost-based payments, payment under a blend of national and hospital-specific rates, and payment floors by class of hospitals (e.g., 90 percent of Medicare capital costs for sole community hospitals). The transition is scheduled to end for most hospitals in 2001.

- There was a statutory, uniform five-year transition to payment under the physician fee schedule, using a blend of each physician's charge-based payment and the new national fee schedule amount. That transition ended in 1996.

- The BBA provides for a four-year uniform transition to resource-based practice expense relative value components under the physician fee schedule, using blends of the charge-based and resource-based values. That transition began January 1, 1999, and is scheduled to end on December 31, 2002.

Each of these transitions posed unique technical and implementation issues. In general, transitions have served well to introduce major changes in payment methodologies without causing abrupt changes in payment levels that could generate financial problems for providers or disrupt services for beneficiaries. The inpatient operating PPS and physician fee schedule transitions were successfully completed without such disruptions and without the need to make major adjustments to the new methodology. The transition to resource based practice expense is expected to proceed smoothly. In the case of capital PPS, adoption of a lengthy and complicated

methodology, geared to the specific needs of very different kinds of hospitals, has not spared the agency from continued lobbying for special treatment of certain costs (e.g., capital taxes), or of special needs (e.g., for urgently needed capital expansions). In 1995, the agency agreed in effect to extend the transition for certain hospitals that have recently undertaken significant expansions by providing for a 70 percent payment floor for up to ten more years.

The general rationale of avoiding abrupt changes in the flow of payments applies in the case of Medicare+Choice risk adjustment. An additional reason for adopting a transition in this case may be the perceived inadequacy of the inpatient-only model that we are constrained to employ in the interim until a comprehensive risk adjustment methodology can be implemented. It can be argued that risk adjustment based only on inpatient data disadvantages organizations that appropriately avoid hospitalization in favor of treatment in outpatient settings. In addition, an inpatient-only model provides only relatively weak incentives for the kind of behavior that risk adjustment in general is supposed to promote. A comprehensive risk adjustment methodology that incorporates inpatient, outpatient hospital, and physician data, creates significantly enhanced incentives for organizations to enroll beneficiaries with poor health status, and conversely to avoid enrolling only healthier beneficiaries.

An inpatient-only model, however, somewhat attenuates these incentives. There is a muted incentive under the inpatient-only model, for example, to select chronically ill individuals, since only diagnoses from inpatient stays result in higher payments. (This effect will, of course, vary substantially to the degree that specific kinds of chronic illness generate hospitalizations.) A

transition strategy for inpatient-only risk adjustment may, then, provide an appropriate way to mitigate the impact of a possibly inadequate model while the agency prepares to implement comprehensive risk adjustment.

A number of transition options were considered. The primary options were: (1) a blend of demographic and risk-adjusted payment rates; and (2) aggregate payment corridors. The blend methodology is familiar from several previous transitions (e.g., both operating and capital PPS). In this case, payment amounts for each enrollee would be separately determined using the demographic and risk methodologies (i.e., taking the separate demographic and risk rate books and applying the demographic and risk adjustments, respectively). Those payments amounts would then be blended according to the percentages for the transition year. Under the payment corridors methodology, total payment to an organization would be constrained to some percentage change (e.g., plus or minus 3 percent) of what the organization would have received under the current methodology. Payment to the organization during the course of a year would be made on the basis of risk-adjusted rates. There would be a periodic settlement in which HCFA would pay the organization, or the organization would reimburse HCFA, whatever is necessary to bring the organization's total payment within the established corridors. As in the case of the blend methodology, we would have to determine the appropriate length of the transition. In this case, HCFA would also have to determine the size of the corridors, whether the corridors would change during the course of the transition (e.g., 3 percent the first year, 6 percent the second year. etc.), and whether the corridors would be symmetrical or asymmetrical.

Based on a variety of analytic and operational considerations, HCFA proposes to implement a transition of risk adjustment using the blended payment approach. The first year blend percentages will be 90 percent of the demographically adjusted rates, and 10 percent of the risk-adjusted payment rate. HCFA has also decided to implement a five-year transition, which will culminate in full implementation of comprehensive risk adjustment, using all encounter data, in the fifth year. The following transition schedule will apply to Medicare+Choice payments:

CY 2000	90 percent demographic method	10 percent PIP-DCG method
CY 2001	70 percent demographic method	30 percent PIP-DCG method
CY 2002	45 percent demographic method	55 percent PIP-DCG method
CY 2003	20 percent demographic method	80 percent PIP-DCG method
CY 2004	100 percent comprehensive risk adjustment (using full encounter data)	

In order to implement comprehensive risk adjustment in CY 2004, HCFA will soon be providing plans with guidance concerning requirements for submission of outpatient, physician, and other non-inpatient encounter data.

HCFA's preliminary analyses of the first year's impact of risk adjustment indicate that these blend percentages should significantly reduce the initial impact to organizations of risk adjustment. Specifically, these analyses suggest that the average decrease in aggregate payments to Medicare+Choice organizations under this transition from risk adjustment alone will be less than 1 percent in the first transition year. While the impact on specific organizations will vary, this preliminary analysis also suggests that the maximum decrease in payment to any organization from risk adjustment alone will be less than 2 percent. HCFA will continue to monitor the impacts

on organizations throughout the transition period.

Treatment of demonstrations: Several commenters on the Federal Register notice asked how the new risk adjustment methodology would apply to current demonstration projects. In particular, these commenters asked about the application of risk adjustment to several important demonstrations that provide services to special populations. These projects are the Social Health Maintenance Organization (SHMO) Demonstration, the Program of All-Inclusive Care for the Elderly (PACE), EverCare, and the Minnesota Senior Care Project.

The Social HMO Demonstration began in 1985 and is scheduled to continue through December 31, 2000. Congress established the Social HMO Demonstration and authorized an enhanced payment methodology that exceeds traditional Medicare payment in recognition of the additional health services mandated for the project's special population. In addition, the Balanced Budget Act of 1997 (BBA) requires the Secretary to develop a plan to transition the Social HMOs to the Medicare+Choice program with a recommendation for a payment approach that takes into account the risk factors appropriate to the population served.

Like the Social HMO demonstration, PACE also has an enhanced payment methodology that was mandated by Congress to reflect its special population. PACE began in 1987 and will be converted to a permanent benefit under Medicare within the next 3 years. Although EverCare does not have the longevity of the other projects, it is a well established 5-year demonstration thar is scheduled to end December 31, 2000. Under the Minnesota Senior Health Options (MSHO)

Project, HCFA and the State have integrated the financing, service delivery, and administrative systems of Medicare and Medicaid to create a unique care system for dually eligible beneficiaries in the Twin Cities metropolitan area.

Because of the unique features of these demonstration projects, we are assessing possible refinements to the risk adjustment methodology. This analysis cannot be completed in time to apply any recommended refinements in the year 2000. Therefore, we have decided to delay implementation of a risk-adjusted payment system for organizations participating in these demonstrations until we have additional information. For these demonstrations, we will temporarily maintain the present payment approaches and not use the M+C risk adjustment model in year 2000.

HCFA is working with the organizations participating in these demonstrations to acquire encounter data that are both claims and survey-based and include inpatient, outpatient, and physician data, as well as functional status information. The objective is to evaluate risk adjustment payment options for the special populations they serve. HCFA plans to collect data in 1998, 1999, and 2000. We are examining the possibility of using a hybrid system after the year 2000.

Reconciliation for late encounter data: Plans have approximately 3 months after the end of a data collection year to submit the encounter data that will be used to develop beneficiary risk scores to their fiscal intermediary. For example, plans must submit encounter data for

the period July 1, 1998 through June 30, 1999 to their fiscal intermediary by September 17, 1999. If plans submit encounters after this date, they will not be incorporated into payments for CY 2000. However, in response to concerns expressed by plans over this short time frame, HCFA expects to institute a reconciliation process that will take into account late data submissions. Plans should attempt to have all data in by the deadline of September 17, 1999. However, if plans receive UB-92s from hospitals after this date, they may submit the encounter to their fiscal intermediary and the data will be processed. Plans should note that the deadline for submission of all data from a payment year will be established (probably June 30, 2000 for the period of July 1, 1998 to June 30, 1999). After that date, the fiscal intermediary will _no_ longer accept these data. After the payment year is completed, HCFA will recalculate risk factors for individuals who have late encounters submitted. Then, we will determine any payment adjustments that are required. This reconciliation will be undertaken after the close of a payment year and will be a one-time only reconciliation for each payment year. Additional information on the reconciliation approach will be provided to plans over the next several months.

CHAPTER 4: SIMULATED IMPACT OF THE PIP DCG-BASED RISK-ADJUSTMENT PAYMENT SYSTEM

This chapter begins with a description of the data used to simulated the impacts of the proposed system relative to the current AAPCC methodology. It continues with a description and discussion of the simulated impacts of risk adjustment by various plan and geographic characteristics.

Under BBA, Medicare+Choice organizations were required to submit data to HCFA regarding inpatient hospital services for periods beginning on July 1, 1997. Data collected for this "start up" year (July 1, 1997 to June 30, 1998) will not be used directly for payment. Rather, these data were collected to estimate the impacts of the PIP-DCG based Medicare+Choice payment system. Plan level impacts from these analyses will also be provided to plans on March 1, 1999 to inform their ACR submission.

Impact Analaysis Methods

The impact analysis presented here employed a "point in time" approach. To estimate the payment impact of the risk adjustment change, we compared actual demographic-based payments to estimated risk adjusted payments for the exact same enrollees for September 1998. Aggregated to the plan level, the difference in these amounts represents a reasonable estimate of change in payment due to risk adjustment.

More specifically, Medicare payments to plans on behalf of enrolled beneficiaries were calculated for September 1998, using the PIP-DCG risk adjusted payment method. This was done using the beneficiary population plans actually enrolled for that month. Diagnoses for managed care enrolled beneficiaries (submitted by plans in the start up year data) were used to assign PIP-DCG-based payment expenditures for these enrollees. Risk-based payment estimates were then converted to relative risk factors (see Chapter 3 for more detail). Then, enrollee risk factors were applied to a restandardized BBA county rate book (see Chapter 4 for more detail on this process) to yield risk adjusted montly payments. Comparing the proposed payment to the actual payments made under the old AAPCC payment yields a typical monthly impact as a result of the new payment system. Once changes in payments at the beneficiary level are estimated, it is a simple process to derive estimates at more aggregated levels such as the plan level or geographic level.

The simulations presented here reflect the data available at the time of the impact analysis. Because the data to be used for actual payments (beginning January 1, 2000) will be based on encounter data for the calendar year beginning on July 1, 1998 and ending June 30, 1999, the actual impact of the risk adjustment system relative to the current demographic system at the time of implementation may differ (due primarily to changes in plan enrollment profiles and possible improvement on plan data quality and completeness). Nevertheless, the impacts reflect the best data and information that we had available at the time of the simulation.

Data representing approximately 1.2 million encounters were submitted to HCFA from 335 Medicare+Choice organizations for over 5.3 million beneficiaries. This excluded data submitted from plans that were involved in demonstration projects, and cost and health care prepayment plans. In this start up year data, the ratio of submitted encounters to enrollees across the all plans is .22 encounters per enrollee. Before performing the simulations we removed plans that had a ratio of less than .12. This was done under the presumption that the data for these plans were not sufficiently complete to perform representative impact simulations. Enrollees for whom we did not have encounter data (e.g., new enrollees) were risk-adjusted using separate demographic factors (See Chapter 2 for a more detailed description of demographic-based factors for new Medicare enrollees). We did not include in the impact enrollee data from plans whose total Medicare enrollment in September, 1998 was less than 30. We also excluded enrollee data from plans that had already chosen not to participate in the Medicare+Choice program as of 1999. Finally, we excluded enrollee data from plans who were not risk-based as of September 1998. These constraints reduced the number of plans from 335 to 195. It reduced the number of beneficiaries from over 5.3 million to 5 million.

The impacts presented here assume FULL implementation of the PIP-DCG based payment system. However, HCFA proposes to blend payments based on the PIPDCG-based model with payments under the old AAPCC method. To determine impacts under the phase-in years, results should be multiplied by the appropriate proportion of the risk adjustment payments. For example. the first year risk adjusted payment phase-in level is 10 percent. Therefore, to estimate the impact under a 10 percent risk adjusted phase in, the impacts can by multiplied by (.10).

Simulated Impacts

If PIPDCG-based payments were to be fully implemented, payments to Medicare+Choice plans would decrease by approximately $180 million, or 7.62 percent. Of the 195 plans, we estimate that 32 would face aggregate payment decreases of between 10 and 15 percent, if the system were implemented in September 1998. The majority, 106 plans, would face payment decreases of between 5 and 10 percent. Seven of the 195 plans are expected to have their payments increase under the PIPDCG-based payment system.

Table 4.1 presents the simulated impacts by region. No regions will experience increased payments under the proposed system. Percent differences vary from a decrease of 9.83 percent for the Philadelphia region to a decrease of for 4.24 percent for the Seattle region.

Table 4.2 presents simulated impacts by State. Only a limited number of States are presented here. This is because sample sizes are so small in the other States and/or the number of plans is so small in these States that showing results could imply the dissemination of proprietary information. These show that of the States presented here, none are expected to experience increases in payments. The results vary from a decrease of 11.14 percent in Iowa to a decrease of 2.63 percent in Massachusetts. But most of the State impacts are much closer to the national estimate.

Table 4.3 presents the simulated impacts for selected high payment and low payment

counties. Again, the simulations show that all counties are likely to experience payment decreases as a result of the new payment system. These results imply that the magnitude of the impact does not seem to vary by the AAPCC-based payment amounts that the plans currently receive.

Table 4.4 presents simulated impacts by plan enrollment size. The variation in impact between the small plans and the large plans does not appear to be systematic.

The results of the simulation clearly show that Medicare+Choice plans are very likely to experience payment decreases under the proposed system. But the simulations also indicate that the direction and magnitude of the historical overpayment that the Medicare program has made to risk HMO's does not vary by any characteristics such as size or geographic location.

Table 4.1

Payment Summary for Selected Plans by Region

Region	Total Number of Enrollees	Percent Difference
01: BOSTON	332,444	-5.56
02: NEW YORK	498,331	-5.42
03: PHILADELPHIA	534,274	-9.83
04: ATLANTA	707,080	-7.51
05: CHICAGO	449,665	-5.88
06: DALLAS	327,624	-7.61
07: KANSAS CITY	148,338	-7.01
08: DENVER	108,809	-6.83
09: SAN FRANCISCO	1,665,086	-8.95
10: SEATTLE	243,613	-4.24
TOTAL	5,015,264	-7.62

Table 4.2

Payment Summary for Selected Plans

States

State	Total Number Of Enrollees	Percent Difference
AZ	210,969	-6.30
CA	1,071,179	-8.72
FL	424,490	-10.19
IA	45,512	-11.14
IL	91,913	-7.11
MA	39,794	-2.65
MI	81,111	-6.17
NJ	261,625	-6.53
NY	184,722	-7.87
OH	210,809	-7.27
OK	59,897	-6.59
OR	242,527	-3.99
PA	141,001	-6.87
TX	42,110	-8.04
VA	114,488	-7.53
WA	206,482	-9.03

Table 4.3

Payment Summary for Selected Plans

Market Area Centered on County

State	County	Total Number of Enrollees	Percent Difference
High Payment			
AZ	Maricopa	153,854	-5.54
CA	Los Angeles	137,872	-5.50
	Sacramento	272,059	-9.55
CO	Denver	430,797	-9.55
FL	Miami-Dade	181,444	-7.06
IL	Cook	146,996	-9.16
LA	Jefferson	22,058	-9.90
MA	Worcester	25,521	-6.20
MD	Baltimore City	42,201	-4.19
MO	Saint Louis	225,900	-11.54
NV	Clark	8,533	-8.28
NY	Kings	93,025	-5.34
OH	Cuyahoga	37,407	-9.04
PA	Philadelphia	100,656	-9.37
TX	Bexar	14,978	-11.64
	Harris	251,468	-6.73
WA	King	19,253	-10.78
Low Payment			
CA	Santa Barbara	54,307	-11.50
NM	Bernalillo	61,239	-5.84
NY	Erie	37,292	-2.44
OR	Multnomah	68,109	-7.55
WA	Clark	4,654	-7.18

Table 4.4

Payment Summary for Selected Plans

Size

Enrollment Size	Total Number of Enrollees	Percent Difference
LESS THAN 500	1,892	-7.25
500 - 2,999	51,408	-7.46
3,000 - 4,999	51,839	-8.64
5,000 - 9,999	259,257	-5.76
10,000 - 24,999	837,285	-6.15
25,000 - 49,999	886,731	-6.51
50,000 - 99,999	1,471,009	-8.06
100,000 OR MORE	1,455,843	-8.77
TOTAL	5,015,264	-7.62

CHAPTER 5: SUMMARY AND FUTURE POLICY DIRECTIONS

The previous chapters of this Report to Congress have outlined the technical approach that HCFA will pursue in meeting the risk adjustment for Medicare+Choice payment mandate. In summary, the approach HCFA will use to meet the year 2000 mandate for risk adjusted payments will:

(1) Be based on inpatient data;

(2) Apply individual enrollee risk scores in determining fully capitated payments;

(3) Utilize a prospective PIP-DCG risk adjuster to estimate relative beneficiary risk scores;

(4) Apply separate demographic-only factors to new Medicare enrollees for whom no diagnostic history is available;

(5) Apply-a rescaling factor to address inconsistencies between demographic factors in the rate book and new risk adjusters;

(6) Use 6 month old diagnostic data to assign PIP-DCG categories (the "time shift" model, as opposed to using the most recent data and making retroactive adjustments of payment rates part way through the year);

(7) Allow for a reconciliation after the payment year to account for late submissions of encounter data;

(8) Phase-in the effects on risk adjustment, beginning with a blend of 90 percent of the demographically adjusted payment rate, and 10 percent of the risk-adjusted payment rate in the first year (CY 2000); and

(9) Implement processes to collect encounter data on additional services, and move to a full risk adjustment model as soon as is feasible.

HCFA has already met the first critical date in the implementation schedule of risk adjustment. On January 15, 1999, HCFA provided 45 day notice to all Medicare managed care plans of the

proposed risk adjustment method; a copy of that notice is attached as Appendix 3. However, the following are additional key dates in the implementation of risk adjustment:

- *March, 1999*

  The annual announcement of payment rates will be released on March 1, 1999. This announcement must include the final county rates for CY 2000, the rescaling factor for each county, the PIP-DCG model, and other information necessary to ensure that readers are able to recalculate the final county rates.

  In addition, each organization will be sent a letter indicating the percentage difference between the organization's payment under risk adjustment and payment under the current system. The letter will also include the distribution of enrollees for an average month by PIP-DCG category and for other demographic factors (e.g., age, gender, Medicaid status, previously disabled, and working aged), and the distribution of PIP-DCG scores for that organization.

- *September, 1999*

  The deadline for receipt of encounter data from the period July 1, 1998 through June 30, 1999 is September 17, 1999. Encounter data received by that date will be used to calculate each enrollee's risk factor to be used in payments to organizations for CY 2000. Data received after that time will be used in a reconciliation process that will be undertaken after the close of the payment year.

- *January, 2000*

  Beginning January, 2000, on a monthly basis, the organization will be provided with information on each enrollee, including the county of residence, age, gender, Medicaid status and previously disabled status, PIP-DCG score, and payment amount.

Independent Actuarial Review

In addition to the submission of this Report to Congress, the BBA also mandated that HCFA obtain an independent review of the "actuarial soundness" of the risk adjustment methodology. To fulfill that mandate, HCFA arranged for the American Academy of Actuaries,

an independent public policy organization, to review the final risk adjustment model and the proposed payment methodology. The full text of the Academy's report, *Actuarial Review of the Health Status Risk Adjustor Methodology,* is attached as Appendix 4.

To conduct this review, the Academy formed a Risk Adjustor Work Group consisting of health actuaries who are consultants of health plans and health insurers, as well as and staff actuaries for health plans or insurers. Because of time constraints, the evolving nature of the policy decision, and data limitations, the Work Group's analysis was limited to the conceptual framework of the risk adjustment methodology.

In summary, the Work Group viewed the PIP-DCG method as the only practical health status risk adjustment alternative available for implementation on January 1, 2000, but noted that there are significant negative implications if the proposed PIP-DCG system is used more than a few years. The Work Group recommended the implementation of a risk adjustment system be based on more comprehensive data as soon as administratively feasible, which is entirely consistent with HCFA's stated intentions. The Academy issued a qualified opinion of the actuarial soundness of the proposal. The measure of "actuarial soundness" applied in this analysis was based on the standards for risk assessment and risk adjustment outlined in the Academy's Health Risk Adjustment Monograph. These standards are: accuracy, practicality and reasonable cost, timeliness and predictability, and resistance to manipulation. In addition, the following goals of effective risk adjustment were also applied: 1) Reducing the effects of either inadvertent

or intentional risk selection, 2) Compensating carriers fairly and equitably for risks they assume, 3) Maintaining consumer choice, and 4) Protecting the financial soundness of the health care system.

Though the Academy Work Group concluded that the risk adjustment method proposed by HCFA meets the test of "actuarial soundness", they also expressed reservations about certain elements of the implementation of the system. Their concerns include: 1) some details of the implementation of the PIP-DCG methodology, particularly those related to one day stays, 2) timing and data collection issues, 3) the lack of adequate testing of the potential impact on health plans and beneficiaries, 4) the element of uncertainty arising from the processing of extraordinary amounts of newly collected data, and 5) using only fee-for-service data to determine the risk adjustment weights. Because of these concerns, the Work Group supports HCFA's decision to use a phased-in approach, so that HCFA and health plans have adequate time assess the impact of the new methodology.

HCFA greatly appreciates the involvement and efforts of the American Academy of Actuaries and in particular, the Risk Adjustor Work Group, in the implementation health status risk adjustment. The following responds to the concerns and recommendations raised by the Academy:

Methodology: There appears to be only one major disagreement on the methodology: the exclusion of one day stays. The Work Group believes that the "benefit" of reducing the

gaming potential is more than offset by the "cost" of reduced predictive power in the model, the potential to penalize more efficient managed care, and the potential to create an incentive to deny hospitalization. HCFA believes the gaming potential is paramount, and is not convinced that plans will deny necessary hospital admissions because of the payment system. The critical issue is not the total proportion of one day stays found in managed care plans, but rather the additional percentage of beneficiaries who are grouped into PIP-DCGs if one day stays are included. Since one day stays are found primarily in the excluded diagnoses (being vague, minor, or transitory), the effect is minimal. In addition, if a beneficiary with an important one day stay also has another serious admission with a longer stay, the one day stay would not be used anyway to assign the beneficiary to a PIP-DCG category.

We ran the fee-for-service data through the PIP-DCG model and did not exclude one day stays. The number of beneficiaries placed in PIP-DCGs groups increased by 0.5 percentage points. Our impact analysis suggests that the analogous increase using managed care encounter data is slightly higher, 0.9 percentage points. Our simulation suggests that the maximum payment implication of inclusion is less than 0.7 percent. This is more than offset by the fact that the system is not being fully phased-in (80% maximum in 2004). This also means that in the first year (CY 2000), the average impact could only be 10 percent of this, or less than 0.07 percent. The true impact is less than the 0.7 percent change, because most of the coefficients for a model that includes the one day stays would also be lower.

Timing and data collection issues: The Work Group states that adequate time is needed to

analyze the large amounts of new data received to support risk adjustment. The data will be used to provide plans with guidance as to the impact of risk adjustment on their plan for the purpose of the ACR process in the Spring of 1999. This start up year data will not be used directly for payment purposes.

HCFA has now had the opportunity to assess the inpatient claims data submitted by the Medicare+Choice plans for discharges occurring between July 1997 and June 1998. The data received appears to be valid and reliable, which suggests that reasonable aggregate and plan level impacts can be produced this year. Total claims per enrollee average about 0.24, which is only slightly below the plan reported average figures of 0.25 collected through the Health Employer Data Information Set (HEDIS) initiative. Other aspects of the data, such as monthly distributions of admissions and completeness of the diagnostic codes, show no particular problem. While the data submission process was slow to start, as is expected in the first year of any new process, we are not aware of any remaining bottlenecks of unprocessed claims.

Lack of adequate testing: HCFA agrees that impact testing as suggested by the Academy is reasonable. However, with only a 10% phase-in in the first year of implementation, it is likely that the data may show little impact and behavioral response to the system. HCFA will compile the recommended types of tests if the PIP/DCG system continues for a longer time period than expected. However, with the emphasis on implementing a comprehensive model in the future, it is likely that HCFA's time and resources will be directed towards this goal,

rather than refining the interim PIP/DCG model. This emphasis is also consistent with the recommendation of the Academy to develop a more comprehensive system as soon as administratively feasible.

Reduce Uncertainty: With the implementation blend of only 10% in the first year, uncertainty in the plan community and Medicare beneficiaries should be allayed. HCFA's preliminary analysis shows that this blend percentage will significantly reduce the impact to the organizations in the first year and should decrease payments by less than 1% in aggregate. While the impact on specific organizations will vary, this analysis also shows that the maximum decrease in payment to any organization will be less than 2 %. We will continue to monitor the impacts on organizations throughout the transition period.

Using only fee-for-service data to determine the risk adjustment weights: The use of fee for service data was required under the BBA, and HCFA had no option to use any other data. In addition, it is not clear whether weights for Medicare+Choice plans should be based only on managed care data, or a combination of Medicare+Choice plan data (HMOs, PPOs, PSOs, and fee-for-service plans) as well as Medicare fee-for-service expenses.

Future Risk Adjustment Policy

HCFA views implementation of the PIP-DCG risk adjustment model as a first step towards

reform of the Medicare+Choice payment system. BBA requires collection of inpatient hospital data, clearly implying that these data form the basis of mandated risk adjustment for Medicare in 2000. However, BBA also allows collection of *additional* data, at the discretion of the Secretary. HCFA has determined that it will require the submission of additional data from Medicare+Choice plans; not only inpatient data, but also physician, hospital outpatient, home health care, other institutional providers, and at a minimum other services currently covered by Medicare in FFS. More specific information and timelines regarding these additional data will be announced by HCFA during 1999. This additional data will enable HCFA to replace the PIP-DCG model with a more powerful "comprehensive" risk adjustment model.

There is substanial agreement both at HCFA and within the managed care industry that a risk adjustment model using diagnoses from both inpatient and outpatient encounters is preferable. When HCFA proceeds with the implementation of full encounter data risk adjustment models, at least two specific methodologies are available; one is the Hierarchical Co-Existing Conditions (HCC) methodology, developed for HCFA by the Boston University/Health Economics Research/Harvard University Consortium (Pope, et. al., 1997) and the other is the Ambulatory Clinical Group (ACG) model developed by a consortium of researchers at the Johns Hopkins University School of Public Health and Lewin/VHI. HCFA technical staff have already begun the process of refining and evaluating a number of possible comprehensive or "full" risk adjustment models. Other models have also been developed by 3-M, Kaiser, and RAND. These continue to be refined.

While comprehensive risk adjustment models differ somewhat, a common element is the grouping of diagnoses from inpatient, outpatient, and physician encounters into categories. This categorization can be based on clinical and/or cost similarities. From this inital grouping, categories are either added or further grouped in way that maximizes the predictive power of the model. Like the PIP-DCG model, comprehensive risk adjustment approaches also include demographic factors, though the proportion of predicted costs driven by demographic factors decreases dramatically as more detailed diagnostic information is added. For example, in the HCC model, the initial classification system is comprised of more than 100 disease based groups. The HCC groups are additive; in other words, unlike the PIP-DCG model in which an individual is assigned one risk grouping, under the HCC model an additional payment amount is added for each disease category. An individual's predicted prospective resource utilization is based on the sum of all appropriate HCC disease categories, combined with demographic factors. Under the ACG system, individuals are placed into a single, mutually exclusive ACG category on the basis of diagnoses identified during the data collection year. ACG categories themselves are defined by groups of individuals whose morbidities reflect similar resource needs in the following year. ACG groups are further categorized into approximately 20 rating cells for the purpose of risk adjustment. Like the HCC model, demographic factors are also used to supplement the diagnostic information.

Estimates made by HCFA staff (using claims data for Medicare beneficiaries gathered from the year prior to Medicare managed care enrollment -- so called "new enrollees") show that implementing a full encounter data model would, on average, double the payment impacts

estimated using only an inpatient-driven risk adjustment system, e.g. the PIP-DCGs. This limited analysis also found mostly parallel impacts at the plan level between the PIP-DCG and HCC based payments. Also, preliminary analyses by HCFA show that there are strong relationships at a county level between impacts under the PIP-DCG and the HCC models. In other words, most areas that would face average reductions under PIP-DCG would face reductions under the HCC model, and the magnitude of those cuts relative to other plans is fairly consistent. Therefore, while implementation of a comprehensive risk adjuster is preferable in the long run to the PIP-DCG model (because of the inherent limitations and biases of this inpatient driven system), significant impacts at the plan level will need to be assessed.

Aside from its use in supporting a comprehensive risk adjustment model, full encounter data is also necessary to maintain the integrity of whatever risk adustment model is in place. As is the case in the implementation of the PIP DCG model, it will be critical to recalibrate full risk adjuster model to account for up-coding or "creep." Under the full encounter data models, payment weights for each diagnosis included in the model were estimated using fee-for-service Medicare expenditures. But after risk adjustment implementation, some diagnoses may be assigned more frequently or diligently as a way for plans to maximize payments. This practice most likely will results in lower average actual expenditures for that recorded illness. The effect is overpayment for these up-coded diagnoses, or "creep". The way to offset this practice is to recalibrate the underlying payment weights periodically, using actual managed care data. In this way, if a certain diagnosis becomes (on average) less expensive after risk adjustment, the recalibration of the model will lower the payment weight assigned to that diagnosis. Critical to the accuracy of risk

adjusted payments, recalibration requires the collection of data on all enrollee encounters, not just those from which diagnosis codes necessary to run the payment model will be obtained.

Making the break from Fee-for-Service

Health status risk adjusted payments under Medicare+Choice -- though an improvement over current demographic adjusted payments in terms of potential "accuracy" and ability to address selection bias -- still have a significant drawback: they are based on fee-for-service practice patterns and costs. Two possible steps could be taken to separate Medicare managed care payments from their traditional fee-for-service basis. The first could be considered an interim approach, and would address the problem of basing managed care payment on fee-for-service practice patterns. If a full encounter data model were implemented, and if a complete set of data were mandated (sufficient to support recalibration), risk adjuster weights could be re-estimated using managed care encounter data (rather than the fee-for-service data used in the models' development), or a combination of managed care and fee-for-service data. In this way, risk score weights and resulting predicted payments would reflect (at least in part) actual managed care practice patterns instead of fee-for-service practice patterns. The remaining aspect of fee-for-service in the approach would be fee-for-service prices, which would be assigned to the managed care encounter data in the absence of reliable information on actual managed care costs.

Subsequently, HCFA could move to what could be called a "direct" payment model. Under this direct model, managed care payments would move away from their current county basis. In

this direct payment approach, risk adjustment models would be calibrated using managed care encounter data, or a combination of managed care and fee-for-service data. BBA currently mandates that county rates be blended with a national rate. At its maximum, this blend would be 50 percent local and 50 percent national by 2003. For the national part of the rate, there is an implicit direct payment model being used for payment to managed care plans. This model may be expressed as follows:

Direct payment = National Medicare+Choice capitation rate
* (Geographic Price index)
* (Enrollee Risk Factor)

Local practice patterns and cost experiences are not used to develop payment rates. This is in direct contrast to the traditional AAPCC policy of using county fee-for-service costs as the basis of managed care payments in each county. Under BBA, the local or county practice patterns are also affected by the BBA provisions in that the practice patterns implicit to the local part of the rates are frozen in time and reflected in the 1997 county rate book. This means that the 1990 to 1994 county practice patterns used to develop the 1997 county rate book will be the basis for all future payments. At some point, a determination will need to be made whether to proceed with the movement towards a fully national rate, or alternately, whether local rates based on county practice patterns will need to be updated to reflect changes over time.

To support this future policy issue, HCFA is planning to undertake additional research. First, we will be developing a more refined geographic price index. BBA specifies an index to be used

at the start, but anticipates the Secretary making improvements to the index. Our initial review of the price index has caused us to consider whether this index should be based on a weighted average of where the providers are located who provide services to the residents of a county, rather than the current method that looks at the input prices faced by providers in the beneficiary's county of residence. This beneficiary-based input price adjuster has the advantage of reflecting higher input price factors in low cost underserved counties where beneficiaries may travel to urban centers to receive their care.

In terms of risk factors, we will continue to develop more refined measures and will test to what extent the combination of the improved risk adjusters and input price factors would be a reasonable substitute for county practice patterns. In any case, Congressional authority would be necessary to extend the national blend to a fully direct model. We believe more supporting evidence would be available over the next year or two to support which options would be the most appropriate.

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APPENDIX 1

Submission of Encounter Data

Based on managed care industry input, HCFA identified three alternatives for the submission of hospital encounter data for discharges during the start-up year:

Option 1: The plan will have its participating hospital(s) submit UB-92s or Medicare Part A ANSI ASC X12 837 records[5] using the traditional HMO 'no pay' bill method.

Option 2: The plan produces/receives from hospitals a complete UB-92/ANSI 837 and submits the data to its designated fiscal intermediary (FI). Once a hospital discharge record has been transmitted to the plan, the plan must add their plan identification number to the UB-92/ANSI 837 record prior to submission to the FI.

Option 3: The plan submits an abbreviated UB-92 data set to its selected FI.

These alternatives were offered to plans as an attempt to gather the mandated data with as little disruption to plans as possible. Regardless of the option(s) selected for data for the start-up year, plans were required to work with their participating hospitals to determine the extent to which each hospital could provide data. The plan had to determine which method(s) will be used for which hospitals for this period. If necessary, the method was allowed to vary by hospital within a plan, and for different time periods during the start-up year.

Plans were required to select one FI from the list provided by HCFA in early February 1998. Plans were instructed at that time to begin identifying an FI with whom to work, and to contact and selected an FI by March 6, 1998; this date was met by the majority of plans. Plans reported their selection to the lead HCFA Regional Office responsible for their organization, along with the location (either plan or directly from the hospital(s)) from which the data would be transmitted to the FI. Encounter data were required for discharges from inpatient hospitals, including facilities reimbursed under the prospective payment system (PPS), long stay hospitals, psychiatric and rehabilitation hospitals, and psychiatric/rehabilitation distinct parts of hospitals. Encounter data were not required for discharges from skilled nursing facilities (SNFs).

Ongoing Data Submissions

Data submission requirements and processes for inpatient hospital diagnoses occurring after July 1, 1998 are somewhat different from the start up year. The main difference is the phasing-out of plans' ability to submit data using either the abbreviated UB-92 (option 3), or to have their participating hospitals submit these data directly to the FI (option 1). Availability of Option 1 was discontinued at the end of the start up year; all data for discharges after July 1, 1998 must be submitted by the plan. The availability of option 3 (submission of an abbreviated UB-92, submitted by plans) was extended as a result of managed care industry feedback.

Regardless of the submission option chosen, and remaining constant from the start up year

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[5] The "Medicare Part A ANSI ASC X12 837" format will be abbreviated as the "ANSI 837" format in the remainder of this document.

through ongoing submission, all data were transmitted using a common route to the plan FI. The FI designated by each plan served as the plans' primary contact for information regarding data transmission, editing, and processing of data. HCFA used the Medicare Data Communications Network (MDCN) operated by IBM Global Services (IGS) to support encounter data transmissions and related data traffic. All fiscal intermediaries were connected to the MDCN prior to the encounter data mandate.

Plans were connected through MDCN to their FI for the purpose of transmitting the UB-92s. Plans were given access to the network in one of three ways. Plans which already had IGS connections were given HCFA authorization (via net IDs and application IDs) for two-way traffic over the MDCN. Larger volume plans without current IGS accounts were authorized for Transmission Control Protocol/Internet Protocol (TCP/IP)[6] enabled frame relay leased line connections. Given the nature of encounter data traffic, HCFA believed 56kb circuits would suffice. Lesser volume plans were provided TCP/IP-based asynchronous dial service to the nearest IGS point of presence (POP). Data exchanges using this type of connection were accomplished using File Transfer Protocol (FTP). (Note that FIs were already required to support TCP/IP and FTP connectivity under HCFA Electronic Data Interchange (EDI) instructions.)

Access to the network was made available via a local call for most plans. Plans outside the local calling area of the nearest IGS POP received 800/888 service. IGS provided these plans with dialer software to facilitate the connectivity. These were important issues in keeping data submission costs as low as possible for plans. In addition, HCFA paid for the installation of leased lines for larger plans (where required) for current plans. HCFA provided the software for medium and smaller current plans that utilize the dial up method, and paid for up to 3 months of line charges for telecommunications between the plan and the FI. The period during which HCFA made these reimbursements lasted from approximately May 31, 1998 through August 31, 1998. By the end of that period, the HCFA sponsored account for a plan was converted to a commercial account for the plan with direct billing by IGS. The expected plan costs for line charges were estimated to be an average of $7600 per year per plan based on access of 8 hours daily for 22 days per month and 90% of users being local to IGS. These figures were reasonably accurate.

Once the FI received files from the plans (or plan hospitals during the start up year) they were uploaded into the FI's processing system. The most immediate response from the FI back to the plan occurred if the file was not readable. In these cases plans had to resubmit the entire file. This problem did not occur often during the start up year. The FI performed data edits normally applied to Medicare fee-for-service UB-92 data. As part of the data edit process, the FIs sent normal edit reports electronically to the plan for data that did not pass the edit screens (termed "failed records"). The plan resubmitted the corrected records with the next batch data submission.

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[6] TCP is responsible for verifying the correct delivery of data from client to server and adds support to detect errors or lost data and to trigger retransmission until the data are correctly and completely received. IP is responsible for moving packets of data from node to node. The IP component provides routing from the enterprise network, to the regional networks, and to the global Internet.

Records passing all edits were then sent from the FI to HCFA's Common Working File (CWF). The CWF is HCFA's main data repository file. For plan encounter data, CWF performed many of the same edits that were done at the FI level, but also performed checks to determine whether beneficiaries could be verified as enrolled in managed care. If records were rejected by the CWF, they were sent back to the plan via the FI. The accompanying CWF response trailer to the FI identified the reason(s) for rejection. If the record was rejected because the beneficiary was not recognized as a managed care enrollee, the plan resubmitted the record with the next batch transmitted to the FI.

One of the most contentious issues related to the collection of plan hospital discharge data centered around HCFA's requirement for "plan attestation." At issue was whether a managed care plan CEO should, or in fact could, attest that the data submitted were accurate, particularly since the mandate from Congress was for a retroactive period, and plans were dependent on hospitals for data collection. HCFA's requirement for plan attestation of data integrity was driven by its intention to pursue penalties under the False Claims Act if it could be proven that a plan knowingly submitted falsified data. Ultimately, HCFA required that hospital encounter data must be submitted over the signature of the Chief Executive Officer (CEO) attesting that the plan submitted the data as reported by the provider (hospital) and that a record for each encounter (hospital discharge) was submitted. For the start-up year, the attestation varied depending upon whether all data for a plan is submitted via Option 1 (in which case, the CEO attests only to the completeness of the data) or whether any data is submitted via Option 2 or Option 3 (in which case, the CEO attests to the completeness of the data and that the data was submitted by the plan as it was reported by the hospital). Attestation as to the validity of the data will be done on a yearly basis. This attestation, at a later point, may be incorporated into the application process for a plan; at that point, a separate attestation will not be required.

As a further method of ensuring data integrity, medical record reviews of a sample of hospital encounters will be audited to ensure the accuracy of diagnostic information. Reviews will be conducted by an independent contractor. The medical record reviews for hospital encounter data may be integrated at a later point into the audit process for the verification of Health Plan Employer Data and Information Set (HEDIS).

APPENDIX 2

“Principal Inpatient Diagnostic Cost Group Models for Medicare Risk Adjustment”

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Principal Inpatient Diagnostic Cost Group Models for Medicare Risk Adjustment

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Executive Summary

The Balanced Budget Act of 1997 requires the Health Care Financing Administration (HCFA) to implement health-status-based risk adjustment for Medicare capitation payments by January 1, 2000. In support of this mandate, the Act requires Medicare risk contractors to supply inpatient encounter data to HCFA beginning in 1998. These data include diagnoses that can be used for Medicare risk adjustment. The purpose of this project is to update and refine risk adjustment models that can satisfy the Balanced Budget Act mandate, including models feasible for the year 2000 in that they rely exclusively on diagnoses reported from hospital admissions.

This project builds on a long line of Diagnostic Cost Group (DCG) risk adjustment research funded by HCFA. The point of departure for the Principal Inpatient Diagnostic Cost Group (PIP-DCG) models of this report is the PIP-DCG model presented in a 1996 report to HCFA, Diagnostic Cost Group and Hierarchical Coexisting Condition Models for Medicare Risk Adjustment (Ellis *et al.*, 1996). The PIP-DCG models presented in this report represent advances over the previous generation of PIP-DCG models (Ellis *et al.*, 1996) in the following respects:

- models are calibrated on 1996 Medicare payments, the first year the Medicare Physician Fee Schedule was fully phased in;
- the diagnostic classification system is refined;

- a payment model is developed that excludes diagnoses that may be minor, transitory, or nonspecific, and that rarely require inpatient hospital care;
- models are developed excluding diagnoses from short-stay hospitalizations;
- four demographic risk adjusters are extensively evaluated, calibrated, and combined with the PIP-DCG model:
    1. Medicaid status, including Medicaid eligibility subgroups;
    2. 'ever disabled' status[1];
    3. institutional status; and
    4. working aged status.
- the age/sex adjustments in the model are refined; and
- the diagnostic codes used in the models are updated to reflect changes in ICD-9-CM[2].

Recommendations

We make the following recommendations for a PIP-DCG payment model that could be implemented in the year 2000.

1. *The PIP-DCG payment model should exclude diagnoses that may be minor, transitory, or non-specific.*

Examples of excluded diagnoses are 'sprains' (minor), 'appendicitis' (transitory), and 'fever' (non-specific). By excluding diagnoses that may be minor, transitory, or nonspecific, risk adjustment focuses on the burden of high-cost, chronic illness. Attaching higher future capitation payments to principal inpatient diagnoses establishes incentives to admit patients

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[1] Ever disabled' status refers to beneficiaries originally entitled to Medicare by disability, but currently entitled by age.

[2] International Classification of Diseases, Ninth Revision, Clinical Modification.

to the hospital. If all diagnoses are included in the risk adjustment model, even relatively healthy people could be admitted for minor diagnoses to obtain higher payment.

> 2. *The two diagnoses 'chemotherapy' and 'HIV/AIDS' are special cases that should be treated differently from other diagnoses. We recommend that the payment model use secondary inpatient diagnoses to assign a cancer diagnosis when the principal inpatient diagnosis is chemotherapy, and that it use both principal and secondary inpatient diagnoses to identify beneficiaries with HIV/AIDS.*

In general, the PIP-DCG model utilizes only principal inpatient diagnoses. But for the two special diagnoses of 'chemotherapy' and 'HIV/AIDS', we recommend that the payment model also use secondary inpatient diagnoses. Diagnosis related group (DRG) coding rules require that Medicare beneficiaries admitted for the primary purpose of chemotherapy have as their primary diagnosis a special ICD-9-CM diagnosis code that denotes a procedure, 'chemotherapy'. The PIP-DCG model is diagnosis-based, and generally excludes procedures. But we feel that admissions for chemotherapy should not be excluded from the PIP-DCG payment model. Beneficiaries undergoing chemotherapy are very ill and have high future costs. We recommend using secondary inpatient diagnoses from chemotherapy admissions to identify the most expensive type of cancer present. The admission is then included in the payment model with the cancer diagnosis replacing the chemotherapy diagnosis.

A second special case is the diagnosis HIV/AIDS, which is also associated with very high future expenditures. Hospital practices for coding this diagnosis as principal versus

secondary for an admission do not seem to be uniform. DRG coding rules allow an admission to be assigned to an HIV-related category with either a principal diagnosis of AIDS or a principal diagnosis of a significant HIV-related condition and a secondary diagnosis of AIDS. Therefore, we recommend that the payment model use both principal and secondary inpatient diagnoses to identify beneficiaries with HIV/AIDS.

3. *We make no recommendation as to whether diagnoses from hospital stays of less than two days should be excluded from the payment model.*

Reasonable arguments can be made for either including or excluding diagnoses from short stay admissions. Our clinical panel, in particular, felt that short stays are often clinically appropriate and should not be excluded. The danger is that added payments for inpatient diagnoses will encourage additional, inappropriate short stay admissions. Our physician panel stressed the importance of monitoring admission patterns under risk adjustment as a means of controlling inappropriate behavior by plans. Clinical review of admission decisions has precedent in the Peer Review Organization (PRO) review of admissions paid under Medicare's Prospective Payment System (PPS). However, ex post monitoring and judging the clinical appropriateness of the many thousands of admission decisions by individual providers and plans is a monumental task, subject to endless disputation.

A more feasible, albeit less clinically cogent, approach is to establish a minimum threshold length of stay required for an inpatient diagnosis to be 'counted' in the payment

model. The greatest danger of inappropriate behavior by plans is encouragement of relatively inexpensive short stay admissions. As a policy matter, excluding diagnoses from these admissions may strike the best balance of administrative feasibility, protection of the Medicare program against manipulation by health plans, and fairness to plans and beneficiaries. There is no reason that a risk adjustment policy need be based on admissions per se only. Length of stay can also be considered. Longer length of stay is a proxy for greater severity of illness (i.e., longer-stay patients, on average, have greater future costs). For the implementation of risk adjustment, focusing only on the more severely-ill longer-stay patients, while eliminating the sensitivity of payments to increased short stay admission of less ill patients, is a reasonable policy decision.

In our 1995 Medicare fee-for-service (FFS) data, only 7 percent of admissions used to assign payment PIP-DCGs are zero or one day stays. If additional future payments for short stays were denied, only a small proportion of admissions would be subject to incentives to increase length of stay. This contrasts with many beneficiaries who are diagnosed with illnesses recognized by the PIP-DCG payment model, but not admitted. Shifting a significant number of these patients from outpatient settings to inpatient wards for short stay diagnostic testing, or minor procedures and therapies, would seem to be a relatively low cost way for health plans to obtain higher Medicare payments. Excluding short stays could significantly reduce incentives to admit patients to the hospital, at the cost of providing an incentive to lengthen stays for a small proportion of admissions.

However, our 1995 FFS data may not be representative of current managed care practice patterns. If managed care organizations are very successful at reducing length of stay, their proportion of short stays may be much higher than our data indicate. Incremental payments based on diagnosis might be foregone for a much larger number of (relatively sick) enrollees, and a higher proportion of admissions might be subject to incentives to lengthen stays. Moreover, excluding short stays might disproportionately disadvantage managed care organizations in certain areas if substantial regional variations in length of stay exist.

We make no consensus recommendation on whether short stay diagnoses should be included or excluded from HCFA's capitation payments. We recommend further consideration of this issue once hospital encounter data from managed care plans become available. HCFA has reported to us that payment simulations using actual managed care data indicate that the effect on aggregate Medicare payments to HMOs of including versus excluding short stays is less that 0.7 percent.

4. *Additional demographic adjustments for 'ever disabled' and Medicaid status should be incorporated into the PIP-DCG model.*

Average Medicare expenditures for beneficiaries also enrolled in Medicaid ('dual eligibles'), and elderly beneficiaries who were previously entitled by disability ('ever disabled'), are substantially higher than predicted by age, sex, and principal hospital diagnoses. Pricing these expensive and vulnerable subgroups correctly requires adding additional demographic factors for them to the PIP-DCG model. Including an ever disabled

factor avoids payment reductions to health plans as under-age-65 disabled individuals 'age in' to elderly entitlement status. Ever disabled and Medicaid status are relatively immune to manipulation by health plans, and are routinely and accurately available in HCFA administrative files. They are good candidates for additional demographic risk adjusters.

5. *The Medicaid demographic adjustment should be prospective, not differentiated by Medicaid eligibility subgroup, triggered by one or more months of base year Medicaid enrollment, and differentiated by age/sex cell. The 'ever disabled' adjustment should vary by age/sex cell.*

We favor a prospective (base year Medicaid enrollment) rather than concurrent (payment year Medicaid enrollment) Medicaid adjustment because a concurrent adjustment appears to be partially measuring acute health care costs/events in the prediction (payment) year. This is not consistent with our prospective risk adjustment framework, which is intended to predict future expenses. We do not recommend payment differences by Medicaid eligibility subgroup. The "medically needy" appear to be more expensive than other dual Medicare/Medicaid eligibles, although on a prospective basis the differences among Medicaid subgroups are not very large. Also, we are concerned about the accuracy and completeness of state reporting of Medicaid eligibility basis to HCFA, about the administrative burden on HCFA of verifying subgroup eligibility, and about variations in state program rules. For these reasons, we do not recommend different payment rates for Medicaid subgroups at this time. We do recommend further evaluation of the quality of

Medicaid subgroup eligibility reporting to HCFA, and monitoring of Medicare expenditure differences among Medicaid subgroups.

We recommend that the Medicaid factor not be differentiated based on number of months of base year Medicaid enrollment because future Medicare expenditures for partial-year enrollees are similar to those for full-year enrollees. We do favor allowing the Medicaid factor to vary by age/sex cell because there are differences in future expenditures by age, in particular. For the same reason, we recommend allowing the 'ever disabled' adjustment to vary by age/sex cell.

6. *The payment model should include an adjustment for beneficiaries for whom Medicare is a secondary payer, the 'working aged'. This adjustment should be a percentage reduction in the relative risk factor predicted by the PIP-DCG model. The adjustment should apply only to months in the payment year in which a beneficiary is in working aged status.*

'Working aged' indicates aged Medicare beneficiaries (age 65 years or more) with private group health insurance coverage from their or their spouse's employer. By law, Medicare is a secondary payer for these beneficiaries. These lower Medicare-covered expenses should be reflected in Medicare payments to capitated organizations who enroll Medicare beneficiaries in working aged status.

Medicare expenditures for the working aged are correlated with the same factors that predict expenditures for the non-working aged, namely, age, sex, and hospital diagnoses. Thus, we developed an approach for the working aged that adjusts payments predicted by the

base PIP-DCG model. We believe a simple, unbiased multiplicative adjustment is preferable.

We estimate that, on average, Medicare payments for the working aged are 21 percent of payments predicted by the PIP-DCG model not considering working aged status. Therefore, Medicare payment for a working aged beneficiary would be 21 percent of payment for a non-working-aged beneficiary with the same age, sex, Medicaid status, ever disabled status, prior year hospital diagnoses, and county location. This percentage reduction applies only to months in the payment year in which a beneficiary is in working aged status.

7. *There should be no adjustment for institutional status in the payment model.*

The PIP-DCG payment model including age, sex, Medicaid status, ever disabled status, and prior year hospital diagnoses predicts average Medicare expenditures for institutionalized Medicare beneficiaries as a whole accurately. An additional demographic adjustment to calibrate payments for this expensive and vulnerable group as a whole is unnecessary. However, wide variations in costs exist among different institutionalized subpopulations.

Institutional status as currently defined by HCFA primarily contains two distinct subpopulations, a very expensive post-acute care population receiving Skilled Nursing Facility (SNF) care, and a much less expensive long-term-care population residing in nursing homes. The expenditures of the first group, receiving post-acute SNF care, are

underpredicted by the PIP-DCG model. For the second, long-term nursing home group, payments predicted by the PIP-DCG model exceed actual expenditures. An institutional status adjustment for nursing home residents alone would be negative. When both groups are combined, the PIP-DCG model predicts payments accurately, on average. This dichotomy is also apparent when comparing predicted and actual expenses for institutionalized Medicare beneficiaries enrolled and not enrolled in Medicaid. Medicaid-enrolled beneficiaries are more likely to be long-term nursing home residents who have ‘spent down’ their assets to qualify for Medicaid. The PIP-DCG model overpredicts their Medicare payments, but underpredicts payments for the non-Medicaid institutionalized.

An overall institutional status adjustment is unnecessary. But should adjustments be made for the institutional subpopulations? Expenditures for long-term nursing facility residents are less than predicted payments, so a payment adjustment for this group would be negative. This seems undesirable because it could discourage needed institutional care for this vulnerable group. Although use of post-acute SNF services in the payment year may be an indicator of illness severity, it seems inconsistent with a prospective, diagnosis-based capitation model to increase payments for current year service use. Therefore, we do not favor any adjustments for institutional subpopulations.

Preferred Payment Model

We created 16 payment PIP-DCGs, with numerical labels ranging from 4 to 29. A PIP-DCG's numerical label is intended to roughly indicate the payment level, in thousands of 1996 dollars, for people classified in this group. Table ES-1 lists the diagnoses assigned to each PIP-DCG. An increase in future capitation payments is attached to the 15 PIP-DCGs 5 through 29. People in PIP-DCG 4, which includes beneficiaries with no prior year hospital admissions, receive no incremental payment beyond demographic adjustments. Altogether, persons in PIP-DCGs 5-29 comprise 13 percent of our 1995/1996 Medicare fee-for-service sample, and 68 percent of sample persons hospitalized in 1995.[3] In other words, if our fee-for-service data are representative of managed care patterns, the payment PIP-DCG model uses principal hospital diagnoses to risk adjust payments for 13 percent (one in eight) of Medicare beneficiaries; the other 87 percent are risk adjusted only by age, sex, and other demographic factors. Capitation payments are increased the following year because of illness for two-thirds of Medicare beneficiaries who were hospitalized in the base year; for one-third of hospitalized beneficiaries, payments are the same as if no hospitalization had occurred. PIP-DCGs are assigned from a person's single highest-future-cost-diagnosis admission. Some people assigned to PIP-DCGs 5-29 have additional lower-cost admissions that are not used in determining their PIP-DCG. In our 1995/1996 fee-for-service sample, 43 percent of all admissions are used to assign PIP-DCGs 5-29.

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[3] The statistics cited in this paragraph refer to the PIP-DCGs with diagnoses from all hospital stays included.

Table ES-2 shows preliminary rate cell factors[4] for the PIP-DCG payment model with short stays excluded. Each beneficiary[5] is assigned a 'demographic factor' from Part I. of the table, and a 'hospitalization factor' from Part II. of the table. The sum of the demographic and hospitalization factors is the beneficiary's total risk adjustment factor for Part A and Part B expenditures. The national average payment is represented by 1.00, and the other rate cell amounts are relative to the national average. For example, a 68 year old woman not enrolled in Medicaid and first eligible for Medicare at age 65 has a relative payment factor of 0.45, or 45 percent of the average. If this woman was hospitalized for leukemia in the year prior to payment, however, the hospitalization factor of 5.10 for PIP-DCG 29 is added to her demographic amount of 0.45, for a total relative payment of 5.55, or 555 percent of average. Excluding 'working aged' beneficiaries, the range across the demographic cells is from 36 percent of average to 177 percent of average. The incremental amounts for prior year hospital diagnoses range from 0 to 510 percent of the average total payment. Factors for working aged beneficiaries are only 21 percent of factors for otherwise equivalent non-working-aged beneficiaries. For example, payment for a 69 year old working aged male, non-Medicaid, never disabled, and not hospitalized in the prior year, is only 11 percent of the average.

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[4] These preliminary rate cell factors are derived from a regression model. Some coefficients are estimated from small sample sizes. Actuarial smoothing of these coefficient estimates (not reflected in Table ES-2) is desirable.

[5] Excluding beneficiaries newly eligible for Medicare, who will be paid using a separate 'new eligibles' model.

These PIP-DCG payment model rate cell factors may be compared to HCFA's current 'Adjusted Average Per Capita Cost', or AAPCC rate cell factors, which are shown in Table ES-3 for the elderly. This comparison is complicated by the division of the AAPCC factors into Part A and Part B, and elderly/disabled/ESRD (elderly only shown in Table ES-3). But some major differences are apparent. The AAPCC 'institutional' rate cells do not appear in the PIP-DCG model, whereas the PIP-DCG 'hospitalization factors' and the 'ever disabled factors' do not appear in the AAPCC. The PIP-DCG model working aged factors are much lower than the AAPCC factors, unless the working aged beneficiary had a prior year hospitalization predictive of much higher future expenditures. As expected, the AAPCC factors are larger than the pure demographic factors of the PIP-DCG model. For example, the Part A AAPCC factor for a 65-69 year old female, non-Medicaid, is 0.55, and the Part B factor is 0.70. The corresponding PIP-DCG factor is 0.45. This is because the PIP-DCG cell includes only those with no (included) hospitalizations. The AAPCC factor averages both those who were hospitalized in the base year and those who were not.[6] If the 65 to 69 year old woman had been hospitalized in the prior year for, say, breast cancer (PIP-DCG 5), her total PIP-DCG factor would be 0.78 (= 0.45 + 0.33), which exceeds the AAPCC factor. Medicaid enrollment raises payments substantially, and its effects appear to be roughly similar, in the two models.

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[6] Although the PIP-DCG cell averages both those who are institutionalized in the payment year, and those who are not, while the AAPCC cell excludes the institutionalized.

Table ES-1

Diagnoses (PIPDxGs) Included in Each PIPDCG, Payment Model

PIPDCG 29

3	HIV/AIDS[a]
15	Blood, Lymphatic Cancers/Neoplasms[b]

PIPDCG 26

7	Metastatic Cancer[b]
20	Brain/Nervous System Cancer[b]

PIPDCG 23

9	Liver/Pancreas/Esophagus Cancer[b]
33	End Stage Liver Disorders
88	Cardio-Respiratory Failure and Shock
134	Decubitus and Chronic Skin Ulcers

PIPDCG 20

27	Diabetes with Chronic Complications
76	Coma and Encephalopathy
112	Aspiration Pneumonia
115	Renal Failure/Nephritis

PIPDCG 18

17	Cancer of Placenta/Ovary/Uterine Adnexa[b]
55	Blood/Immune Disorders
72	Paralytic and Other Neurologic Disorders
75	Polyneuropathy
108	Gram-Negative/Staphylococcus Pneumonia

PIPDCG 16

8	Mouth/Pharynx/Larynx/Other Respiratory Cancer[b]
13	Lung Cancer[b]
34	Cirrhosis, Other Liver Disorders
89	Congestive Heart Failure
95	Atherosclerosis of Major Vessel
105	Chronic Obstructive Pulmonary Disease

Table ES-1 (continued)

Diagnoses (PIPDxGs) Included in Each PIPDCG, Payment Model

PIPDCG 14

2	Septicemia (Blood Poisoning)/Shock
29	Adrenal Gland, Metabolic Disorders
58	Delirium/Hallucinations
61	Paranoia and Other Psychoses
63	Anxiety Disorders
66	Personality Disorders
70	Degenerative Neurologic Disorders
144	Spinal Cord Injury

PIPDCG 12

4	Tuberculosis
10	Stomach, Small Bowel, Other Digestive Cancer[b]
12	Rectal Cancer[b]
19	Cancer of Bladder, Kidney, Urinary Organs
22	Benign Brain/Nervous System Neoplasm
26	Diabetes with Acute Complications/Hypoglycemic Coma
41	Inflammatory Bowel Disease
48	Rheumatoid Arthritis and Connective Tissue Disease
49	Bone/Joint Infections/Necrosis
56	Dementia
57	Drug/Alcohol Psychoses
60	Major Depression/Manic and Depressive Disorders
73	Epilepsy and Other Seizure Disorders
91	Cerebral Hemorrhage
93	Stroke
98	Peripheral Vascular Disease
111	Pulmonary Fibrosis and Bronchiectasis
113	Pleural Effusion/Pneumothorax/Empyema

PIPDCG 11

42	Gastrointestinal Obstruction/Perforation
45	Gastrointestinal Hemorrhage
87	Paroxysmal Ventricular Tachycardia
109	Bacterial Pneumonia
133	Cellulitis and Bullous Skin Disorders

Table ES-1 (continued)

Diagnoses (PIPDxGs) Included in Each PIPDCG, Payment Model

PIPDCG 10

11	Colon Cancer[b]
59	Schizophrenic Disorders
81	Post-Myocardial Infarction
83	Unstable Angina
97	Thromboembolic Vascular Disease
116	Kidney Infection
143	Vertebral Fracture Without Spinal Cord Injury

PIPDCG 9

21	Other Cancers[b]
32	Pancreatitis/Other Pancreatic Disorders
82	Acute Myocardial Infarction
94	Transient Cerebral Ischemia
145	Fractures of Skull/Face
146	Pelvic Fracture
147	Hip Fracture
150	Internal Injuries/Traumatic Amputations/Third Degree Burns

PIPDCG 8

16	Cancer of Uterus/Cervix/Female Genital Organs[b]
36	Peptic Ulcer
77	Valvular and Rheumatic Heart Disease
79	Hypertension, Complicated
80	Coronary Atherosclerosis
84	Angina Pectoris
86	Atrial Arrhythmia
92	Precerebral Arterial Occlusion
96	Aortic and Other Arterial Aneurysm
110	Asthma
153	Brain Injury
158	Artificial Opening of Gastrointestinal Tract Status

PIPDCG 7

1	Central Nervous System Infections
39	Abdominal Hernia, Complicated
64	Alcohol/Drug Dependence

Table ES-1 (continued)

Diagnoses (PIPDxGs) Included in Each PIPDCG, Payment Model

PIPDCG 6	
18	Cancer of Prostate/Testis/Male Genital Organs[b]
PIPDCG 5	
14	Breast Cancer[b]
131	Ongoing Pregnancy with Complications
132	Ongoing Pregnancy with No or Minor Complications
PIPDCG 4	
0	No or Excluded* Inpatient Admissions
126	Ectopic Pregnancy
127	Miscarriage/Terminated Pregnancy
128	Completed Pregnancy with Major Complications
129	Completed Pregnancy with Complications
130	Completed Pregnancy without Complications (Normal Delivery)

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[a] Includes principal and secondary inpatient diagnoses of HIV/AIDS.

[b] Includes principal diagnoses and secondary diagnoses when the principal diagnosis is chemotherapy. See text.

*See Table 3-1 for diagnoses excluded from the payment model.

SOURCE: Health Economics Research, Inc.

Table ES-2

Preliminary Rate Cell Factors for the PIPDCG Payment Model (Short Stays Excluded)[1]
(1.00=national average)

		Non-Medicaid		Medicaid		Working Aged
		Never Disabled	Ever Disabled	Never Disabled	Ever Disabled	Non-Medicaid, Never Disabled[2]
I. Demographic Factor (one per person)						
MALE	0-34	n/a	0.36	n/a	0.48	n/a
	35-44	n/a	0.37	n/a	0.66	n/a
	45-54	n/a	0.48	n/a	0.84	n/a
	55-59	n/a	0.60	n/a	0.99	n/a
	60-64	n/a	0.75	n/a	1.10	n/a
	65-69	0.53	0.94	0.97	1.37	0.11
	70-74	0.69	1.09	1.14	1.54	0.15
	75-79	0.89	1.22	1.35	1.68	0.19
	80-84	1.06	1.34	1.49	1.77	0.22
	85-89	1.24	1.30	1.67	1.73	0.26
	90-94	1.35	1.42	1.62	1.68	0.28
	95+	1.33	1.40	1.63	1.69	0.28
FEMALE	0-34	n/a	0.36	n/a	0.53	n/a
	35-44	n/a	0.40	n/a	0.73	n/a
	45-54	n/a	0.52	n/a	0.85	n/a
	55-59	n/a	0.63	n/a	1.06	n/a
	60-64	n/a	0.88	n/a	1.24	n/a
	65-69	0.45	1.04	0.89	1.49	0.09
	70-74	0.58	1.15	0.99	1.57	0.12
	75-79	0.73	1.24	1.19	1.69	0.15
	80-84	0.90	1.25	1.34	1.69	0.19
	85-89	1.08	1.41	1.37	1.70	0.23
	90-94	1.14	1.47	1.38	1.72	0.24
	95+	1.11	1.44	1.21	1.54	0.23

II. Hospitalization Factor (one per person -- add to demographic factor)

	Not Working Aged	Working Aged
PIPDCGs 4	0.00	0.00
5	0.37	0.08
6	0.45	0.09
7	0.69	0.14
8	0.81	0.17
9	0.90	0.19
10	1.15	0.24
11	1.25	0.26
12	1.63	0.34
14	1.97	0.41
16	2.40	0.50
18	2.61	0.55
20	3.34	0.70
23	3.76	0.79
26	4.30	0.90
29	5.10	1.07

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[1] From Tables 8-7 and 6-3 Preliminary, subject to actuarial smoothing of regression coefficients

[2] Working aged demographic factors are shown only for the non-Medicaid, never disabled. Factors for the non-Medicaid, ever disabled and Medicaid, never and ever disabled may be obtained by multiplying the amounts in the appropriate column to the left by 0 21

NOTES:
Combined Part A and Part B expenditures Includes both aged and disabled ESRD enrollees and expenditures excluded
Indirect Medical Education and hospice expenditures excluded
Rate cell denominator: Overall Sample Mean, $5,186
Ever-disabled score for male and female 90-94, 95+ was set to value for age 85-89
n/a = 'not applicable'

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SOURCE Health Economics Research, Inc analysis of 1995 and 1996 Medicare data

Table ES-3

1999 AAPCC Demographic Cost Factors for the Aged

			Institutional	Non-Institutional		
Part	Sex	Age		Medicaid	Non-Medicaid	Working Aged
A	Male	65 - 69	1.75	1.15	0.65	0.40
		70 - 74	2.25	1.50	0.85	0.45
		75 - 79	2.25	1.95	1.05	0.70
		80 - 84	2.25	2.35	1.20	0.80
		85 & Over	2.25	2.60	1.35	0.90
	Female	65 - 69	1.45	0.80	0.55	0.35
		70 - 74	1.80	1.05	0.70	0.45
		75 - 79	2.10	1.45	0.85	0.55
		80 - 84	2.10	1.70	1.05	0.70
		85 & Over	2.10	2.10	1.20	0.80
B	Male	65 - 69	1.60	1.10	0.80	0.45
		70 - 74	1.80	1.35	0.95	0.65
		75 - 79	1.95	1.55	1.10	0.80
		80 - 84	1.95	1.70	1.15	0.90
		85 & Over	1.95	1.70	1.15	1.00
	Female	65 - 69	1.50	1.05	0.70	0.40
		70 - 74	1.65	1.15	0.85	0.55
		75 - 79	1.65	1.25	0.95	0.70
		80 - 84	1.65	1.25	0.95	0.75
		85 & Over	1.65	1.25	1.00	0.85

SOURCE: Public use file maintained on HCFA's website.

1

Introduction and Overview

The Balanced Budget Act of 1997 requires the Health Care Financing Administration (HCFA) to implement health-status-based risk adjustment for Medicare capitation payments by January 1, 2000. In support of this mandate, the Act requires Medicare risk contractors to supply inpatient encounter data to HCFA beginning in 1998. These data provide a source of diagnoses that can be used for Medicare risk adjustment. The purpose of this project is to update and refine risk adjustment models that can satisfy the Balanced Budget Act mandate, including models feasible for the year 2000 using only inpatient diagnoses.

This project builds on a long line of Diagnostic Cost Group (DCG) risk adjustment research funded by HCFA directed towards improving Medicare capitation payments. The point of departure for the Principal Inpatient Diagnostic Cost Group (PIPDCG) models that are the focus of this report is the PIPDCG model presented in a 1996 report to HCFA, Diagnostic Cost Group and Hierarchical Coexisting Condition Models for Medicare Risk Adjustment (Ellis *et al.*, 1996). Other recent HCFA-funded DCG and risk adjustment research that this project builds on is reported in Revised Diagnostic Cost Group/Hierarchical Coexisting Conditions Models for Medicare Risk Adjustment (Pope *et al.*, 1998a), Risk Adjustment for the Non-Elderly (Ash *et al.*, 1998), and Evaluating Alternative Risk Adjusters for Medicare (Pope *et al.*, 1998b). These reports develop and evaluate DCG models that include secondary inpatient and ambulatory diagnoses as well as principal

inpatient diagnoses[1], DCG models for Medicaid and privately-insured populations, and survey and combined claims/survey models.

The PIPDCG models presented in this report represent advances over the previous generation of PIPDCG models (Ellis *et al*., 1996) in the following respects:

- models are calibrated on 1996 Medicare payments, the first year the Medicare Physician Fee Schedule was fully phased in;
- the diagnostic classification system is refined;
- a payment model is developed that excludes diagnoses that may be minor, transitory, or nonspecific, and that rarely require inpatient hospital care;
- models are developed excluding diagnoses from short-stay hospitalizations;
- four demographic risk adjusters are extensively evaluated, calibrated, and combined with the PIPDCG model:
    1. Medicaid status, including Medicaid eligibility subgroups;
    2. 'ever disabled' status[2];
    3. institutional status; and
    4. working aged status;
- the age/sex adjustments in the model are refined; and
- the diagnostic codes used in the models are updated for changes in ICD-9-CM[3].

This report is organized as follows. Chapter 2 describes data, file construction, and variable creation. Chapter 3 describes refinement of the PIPDCG diagnostic classification,

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[1] Models including diagnoses from all settings are known as the Diagnostic Cost Group/Hierarchical Coexisting Conditions, or DCG/HCC, models.

[2] 'Ever disabled' status refers to beneficiaries originally entitled to Medicare by disability, but currently entitled by age.

[3] International Classification of Diseases, Ninth Revision, Clinical Modification.

and motivates exclusions of selected diagnoses from the payment model. Chapter 4 discusses development of the baseline PIPDCG model including only age, sex, and principal hospital diagnoses. Chapter 5 adds two demographic factors, Medicaid, and 'ever disabled' status, to the base PIPDCG model. Chapter 6 adds an adjustment for 'working aged', the elderly for whom Medicare is a secondary payer, to the base model. The base model's accuracy in predicting the expenditures of institutionalized beneficiaries, and models incorporating an 'institutional factor', are analyzed in Chapter 7. Excluding diagnoses from short-stay hospitalizations is discussed in Chapter 8. Chapter 9 presents results of validating selected models. An appendix volume contains tables of additional data and diagnostic crosswalks.

2

Data and File Construction

A major part of this project was to develop a 1995/1996 file of Medicare enrollment, expenditure, and diagnosis information to develop and analyze risk adjustment models. The sample selection and file construction processes were similar to our previous work for HCFA (Ellis *et al*., 1996). Two major innovations are the use of a Medicaid eligibility file to more precisely define Medicaid subgroups, and explicit identification of beneficiaries for whom Medicare is a secondary payer (the 'working aged'). In this chapter we first describe sample selection, then define our Medicare payment variable and information used for risk adjustment, and close by comparing sample frequencies and expenditures to the 1991/1992 data used in our previous work.

2.1 Sample Selection

2.1.1 Overview

All claims and eligibility information for this analysis fall in the two-year interval January 1, 1995 through December 31, 1996. During the data acquisition phase of this project, 1995/1996 were the most recent calendar years of Medicare data available. The sample includes Medicare expenditures in 1996, which was the first year in which the Medicare physician fee schedule was fully phased in.

2.1.2 Sample Selection Criteria

The sample includes the universe of beneficiaries appearing in HCFA's five-percent Standard Analytic File sample who were alive and enrolled in Medicare on January 1, 1996, and for 1995 (January 1, 1995 - December 31, 1995). From this universe, the "1995-1996 modeling sample" was defined by excluding all of the following:

- beneficiaries covered under the End Stage Renal Disease (ESRD) program at any time during 1995 or 1996;
- beneficiaries who were not continuously enrolled in both Part A and Part B Medicare for the entire period January 1, 1995 to December 31, 1996, or the period from January 1, 1995 until the month of their death during 1996;
- beneficiaries enrolled in a Health Maintenance Organization (HMO) at any time during 1995 or 1996;
- beneficiaries who reported their state of residence as outside the 50 states and Washington DC during 1995 or 1996;
- beneficiaries who entered hospices on or prior to January 1, 1996; and
- beneficiaries who had group insurance from their own or their spouse's employer at any time during 1995 or 1996.

Beneficiaries in the ESRD program were excluded because they are a distinct, high cost group with a separate reimbursement system.[1] The purpose of the remaining exclusions was to be confident that we had a complete set of all Medicare claims for each included person during the eligible period. The second exclusion criterion imposes the requirement that people in our sample are eligible for the full year of 1995 so that we observe 12 months of

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[1] A proposed capitation model for this group is developed in Farley, *et al.* (1994)

1995 claims for identifying diagnoses, and a full set of claims for 1996 for such time as the enrollee was alive, on which to estimate total payments for 1996. This sample excludes anyone who dies in 1995 or becomes eligible after January 1, 1995. Thus, new Medicare eligibles (e.g., 65 year olds) are not present in the prediction year (1996) of our sample. The sample includes both people dying during 1996 and those who live on into 1997.

The fifth and sixth exclusions ensure a complete 1995 diagnosis profile for a group that represents those who will be enrolled in capitated managed care plans. Medicare regulations specify that managed care plans are not responsible for hospice care, so predicting expenditures for hospice residents is not relevant to our study. Also, since Medicare is only a secondary payer for beneficiaries with private group insurance from employers, Medicare's claims for such beneficiaries are incomplete.

The final study sample includes 1,387,105 Medicare beneficiaries.

2.1.3 Sample Selection Process

In creating our analytic file, we first selected individual beneficiaries from the Medicare enrollment history files. The original study sample was selected from the 1995 denominator 5% file and was created by HCFA based on the following criteria:

1. Beneficiaries must be part B eligible for at least March 1, 1995 through December 31, 1995.
2. Beneficiaries could not be in HMOs during March 1, 1995 through December 31, 1995 or in 1996.
3. Beneficiaries had to be alive on January 1, 1996.

4. Beneficiaries covered under the End Stage Renal Disease (ESRD) program at anytime during 1995 or 1996 were excluded.[2]

Further sample selection was performed by Health Economics Research, Inc. (HER) staff. The following groups of beneficiaries were additionally excluded:

1. Beneficiaries who were not eligible for both Part A and Part B for either of the following: the entire period January 1, 1995 to December 31, 1996, or the period from January 1, 1995 until the month of their death during 1996. This step excluded 33,039 beneficiaries.

2. Beneficiaries who reported their state of residence as outside of the 50 states and Washington DC. during any time in 1995 or in 1996. This step excluded 2,447 beneficiaries.

3. Beneficiaries who entered hospices on or prior to January 1, 1996: We identified beneficiaries who entered hospices in 1995 or 1996 based on hospice claims. We used the "claim from date" on hospice claims as the date a beneficiary entered a hospice. For beneficiaries with multiple hospice claims, the date of entering a hospice was the earliest "claim from date". This step excluded 2,650 beneficiaries.

4. Beneficiaries with group insurance from their employer or their spouse's employer during any time in 1995 or in 1996. This step excluded 20,199 beneficiaries.

2.1.4 Differences from previous work in sample selection criteria

The selection criteria for the 1995/1996 sample employed in this project differ from those for the 1991/1992 sample used in our previous work (Ellis *et al.*, 1996) in two respects. First, two groups of beneficiaries who were excluded from the previous DCG project (Ellis *et al.*, 1996) are included in the 1995/1996 sample: (1) beneficiaries who changed their

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[2] A non-ESRD beneficiary from the denominator file had to meet the following three criteria: 1) ESRD indicator is 0 (non-ESRD program); 2) Medicare Status Code is 10 (aged without ESRD) or 20 (disabled without ESRD); and 3) Current Reason for Entitlement (CREC) is 0 (aged) or 1 (disabled).

Medicare Identification Numbers during the study period; and (2) beneficiaries classified as Rail Road Board retirees. Identifying Medicare claims for beneficiaries who changed their Medicare Identification Numbers requires extra data processing efforts that were completed for this project, but not previously. Also, in the previous DCG project, "railroad retirees" were excluded because of incomplete demographic data (age) for spouses; this problem was fixed in the 1995/1996 sample.

Second, two groups of beneficiaries who were included in the original sample were excluded in the 1995/1996 sample: (1) beneficiaries who entered hospices in the first study year; and (2) beneficiaries with group insurance from employers in the first study year. As discussed above, the purpose of these exclusions is to ensure a complete base year (1995) diagnostic profile for the study sample.

2.2 Construction of the 1996 Medicare Expenditure Variable

2.2.1 Included Expenditures

Payments from five 1996 claims files were aggregated to create the base 1996 annual expenditure total for each beneficiary: inpatient[3], hospital outpatient, physician/supplier (Part B), home health, and durable medical equipment (DME). Our 1996 Medicare expenditures do not include deductibles and copayments paid by Medicare beneficiaries (or

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[3] The 1996 MEDPAR file was used to aggregate inpatient expenditures. The file contains claims from PPS hospitals, TEFRA hospitals, and SNFs.

their supplemental insurance). Table 2-1 summarizes the method of calculating payments for each type of claim for 1996 expenditures.

For Prospective Payment System (PPS) inpatient facilities, expenditures were based on the total recorded payment amount for each discharge in a Diagnosis-Related Group (DRG), including direct teaching payments, outlier payments, and organ transplant payments. For Tax Equity and Fiscal Responsibility Act (TEFRA) facilities (that are not paid on the basis of DRGs) recorded payments were used. For physician/supplier, home health, hospital outpatient and DME claims, we used the "paid amount" to reflect Medicare expenditures.

2.2.2 Excluding Hospice and Medical Education Expenditures

Two types of payments were excluded from the base 1996 expenditure, hospice care and indirect medical education (IME). Medicare expenditures for hospice care were not included in 1996 total expenditures because Medicare HMOs are not responsible for hospice care. Once a beneficiary enters a hospice, he/she must disenroll from a managed care plan. HCFA stops paying the Medicare capitation rate to a managed care plan the month after the beneficiary enters the hospice. Therefore, for enrollees who entered hospices after January 1, 1996, all expenditures—both hospice and non-hospice--incurred on and after hospice entry were not included in 1996 total expenditures. Non-hospice expenditures were excluded as well as hospice costs because Medicare regulations require that treatment for conditions other than the terminal condition be paid on a fee-for-service basis during hospice stays.

The Balanced Budget Act of 1997 specifies that Graduate Medical Education (GME) amounts are to be "carved out" of capitation payments to managed care plans, and paid directly to teaching hospitals. Under Medicare PPS, there are two GME payment components: direct medical education (DME) and indirect medical education (IME). In 1997, IME and DME payments accounted for 5.4% and 2.6% of total Medicare inpatient payments, respectively. In other word, IME payments account for about two-thirds of GME. Interim DME payments are made to hospitals at regular dates during the year, while interim IME payments are made on a per discharge basis. Final GME amounts for each hospital are determined when hospitals submit their Medicare Cost Report (MCR). Interim GME shortfalls and overpayments are, thus, reconciled when the MCR is "accepted" by HCFA.

Ideally, it would be desirable to exclude both IME and DME payments from 1996 expenditures. Removing non-capital IME payments[4] from total Medicare expenditures is straightforward by subtracting the *IME amount* field in a MedPAR record[5] from the total PPS payment that is the sum of the *Amount Reimbursed* field and the *Bill Total per Diem* field (total pass through cost). However, DME is included in the pass through costs in a MedPAR record along with own-capital costs, organ acquisition costs, bad debt, and miscellaneous costs. Excluding DME from each inpatient claim requires estimating it by hospital from MCRs and recovering the method that each Medicare Fiscal Intermediary (FI) uses to compute interim DME for 1996 bills. Removing DME was beyond the scope of this project.

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[4] Capital IME is not carved out of capitation payments.

[5] The interim IME amounts on the MedPAR claims are not adjusted to be consistent with the final reconciled amount for each hospital.

As a result, IME payments are excluded from our base 1996 expenditures, while DME payments are included. That is, approximately two-thirds of medical education payments are removed, while one-third are not.

Failure to exclude DME payments should create only a minor bias for our purpose. We are primarily interested in *relative*, not absolute expenditures. Bias will only result when a diagnosis is treated disproportionately in hospitals to which high medical education payments are made. To the extent that such bias is present, it should be small. See Appendix 2-A for details of PPS Graduate Medical Education payments. _

2.2.3 Annualization of Expenditures and Weighting

To correctly estimate monthly payments for all beneficiaries, including people who died, we weight observations by Medicare-eligible months in the prediction year (Ellis *et al.*, 1996). First, annualized 1996 payments are calculated as actual total 1996 payments divided by the fraction of the year (rounded up to the nearest whole month) that each beneficiary is alive and eligible for Part A and B. When estimating regressions and calculating statistics, we weight each observation by the same fraction. The process of annualizing and weighting observations results in unbiased estimates of the average and total payments for a group in which individuals are eligible for different fractions of the year.

2.2.4 Expenditure Distribution and Variants

Table 2-2 presents the distribution of annualized expenditure in 1996. It ranges from zero to $3.3 million, with a mean of $5,186. Nearly 10 percent of individuals in our sample incurred no Medicare payments in 1996[6], and 4.8% died in 1996.

In addition to base 1996 expenditures, we also created two expenditure variants: the base 1996 expenditure plus IME payments and the base expenditure plus payments for both IME and hospice care. Table 2-3 displays means of these two variants plus base 1996 expenditures by study sample. For the PIPDCG sample, including IME payments increases the mean 1996 expenditure by $122 (from $5,186 to $5,318), while including both IME and hospice payments increases the mean 1996 expenditure by $172 (from $5,186 to $5,358). As expected, when the 'working aged' are included in the study sample the mean base 1996 expenditure falls, from $5,186 to $5,140.

2.3 Information Used for Risk Adjustment

2.3.1 Age, Sex, and Disability Status

We obtained beneficiary age and sex from Medicare enrollment files and classified each person into one of 24 age/sex cells. This is two more than used previously (Ellis *et al.*, 1996) because each of the male and female age 55 to 64 year old cells is decomposed into one for age 55 to 59 and another for 60 to 64. Disability as a reason for Medicare coverage

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[6] Zero Medicare payments does not necessarily imply no use of medical services. Individuals with zero payments may be below the Medicare Part B deductible, or may have used non-Medicare covered services.

uniquely corresponds to being under age 65. Hence, the marker for being under age 65 is also a marker for disability. "Ever"-disabled status was also included as a demographic factor. "Ever" disabled is defined as a Medicare beneficiary who is currently (1996) entitled by reason of age (65 or over), but whose "original reason for entitlement" was disability. That is, the "ever-disabled" are elderly beneficiaries who were originally enrolled in Medicare because of a disability and have "aged into" aged entitlement status. In previous work, beneficiaries have been classified by age and disability status based on their age on January 1 of the prediction year, in our case, January 1, 1996. We created these variables for comparison with earlier work.

An alternative procedure for defining age and eligibility variables is to allocate them according to the number of months in each status. Medicare capitation payments are adjusted monthly based on a person's age. For Medicare capitation payment, a person's age on the first day of a month determines their age for the entire preceding month. For example, a person's age for January is his/her age as of February 1; a person's age for February is his/her age as of March 1, etc. If a person ages into an older age/sex group, then his/her capitation rate will be adjusted accordingly.

We created alternative age cell variables based on months during 1996 in each age range. Based on date of birth, we computed a person's age for each month of 1996 based on the "first of the month" rule specified in the previous paragraph. Then we counted the number of months a person was a given age during 1996 and divided by 12 (assuming the person lived through the year) to get the fraction a person was a given age during 1996. For

example, if a person was 69 for 3 months and 70 for 9 months, the fractions would be age 69=3/12=0.25, and age 70=9/12=0.75.

We adjusted our prorated age variables for death and hospice entry. If a person died or entered a hospice during 1996, we assigned an age to each month they were alive, or before they entered a hospice. That is, entering a hospice was treated equivalently to death. Then we divided by number of months the person was alive (or before entering a hospice) to determine the fractions they were each age. A person was considered alive for a month if they were alive for one or more days during that month. For example, suppose a woman was age 74 at the beginning of 1996, turned 75 on April 5, and died on August 10. Thus, she was 74 for 3 months and 75 for 5 months, living for 8 months in total in 1996. So she was 74 for 3/8 = 0.375 of her total 1996 enrollment, and 75 for 5/8 = 0.625 of it.

We assigned a person to the 24 age/sex groups based on his or her monthly ages. If a person's age during 1996 fell totally within a given age range (e.g. a man who was 66 at the start of 1996 was totally within the male 65-69 age group), then he was assigned a "1" for that group, and "0" for all other age/sex groups. If a person's age "crossed" age groups, we "prorated" the membership in these two groups. For example, a woman who was 79 for 3 months during 1996 and 80 for 9 months was given a value of "0.25" for the female 75-79 group and "0.75" for the female 80-84 group, and "0" for all other groups. A person has at most 2 nonzero values for age/sex groups, and the age/sex group values sum to 1 for each person.

Similarly, disability status was determined by month. For enrollees eligible for Medicare coverage due to disability who turn age 65 during 1996, we allocated eligibility according to the number of months eligible for each type of coverage. For example, if a disability-entitled man is 64 for 9 months during 1996 and 65 for 3 months, he is coded 0.75 for disability status and 0.25 in the age 65-69 cell, and 0.25 in "ever-disabled" status (aged, originally entitled by disability). Below age 65, age and disability status are the same, but for age 65 and older, both an age cell and a separate variable for "ever-disabled" are defined.

2.3.2 Medicaid enrollment

Medicaid status is included in selected risk adjustment models as a demographic risk adjuster. Medicaid 'buy-in' status is used to indicate Medicaid enrollment. 'Buy-in' refers to states paying the Medicare Part B premium for their Medicaid enrollees who are also entitled to Medicare.[7] These people are referred to as 'dual Medicare-Medicaid eligibles' or 'dual eligibles' for short. Dual eligibles can be classified into several subgroups by their reason for Medicaid entitlement. In particular, certain dual eligible subgroups enjoy full Medicaid benefits (e.g., prescription drugs, nursing home care) in addition to their Medicare benefits, while for other, generally higher income groups, Medicaid pays only the Medicare Part B premium and/or deductibles and copayments.

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[7] In a small number of cases, for beneficiaries not entitled to Medicare Part A, states also pay a Part A Medicare premium for Medicaid enrollees.

In our previous work (Ellis *et al.*, 1996), we obtained Medicaid enrollment status from HCFA's 'denominator' file. The denominator file does not distinguish Medicaid subgroups. The Medicaid information on the denominator file originates from another HCFA file, the Entitled Action Records for Third Parties (TP-EARTH) file. The TP-EARTH file contains a full history of all Medicare beneficiaries who have ever been Medicaid buy-ins. HCFA bills the states for these premiums based on this file. The TP-EARTH file contains a "buy-in eligibility code" that distinguishes among Medicaid subgroups.

We found a very high, but not perfect match rate between the denominator file Medicaid indicator and the TP-EARTH file. Specifically, months of Medicaid eligibility matched exactly for 98.26 percent of beneficiaries with Medicaid eligibility in 1995 on the TP-EARTH file. And months of eligibility matched exactly for 98.92 percent of beneficiaries with Medicaid eligibility on the denominator file. Where the two files differed, we used the TP-EARTH variable to be consistent between our overall and subgroup Medicaid eligibility analyses. One reason for non-matches is Medicare beneficiaries who change Medicare identification number (HICNO). The denominator and TP-EARTH files are regularly updated and recreated, with beneficiaries classified by current HICNOs. This leads to some non-matches between denominator and TP-EARTH files created on different dates.

Based on the TP-EARTH file, we categorized Medicaid buy-in eligibility for Medicare beneficiaries into the following four groups:

- Qualified Medicare Beneficiaries (QMBs) only: Beneficiaries with incomes within 100 percent of federal poverty level but who do not meet SSI

criteria.[8] The state Medicaid program pays their Part B premium, all deductibles and coinsurance.

- Specified Low-Income Medicare Beneficiaries (SLMBs): Medicare beneficiaries with incomes within 120 percent of federal poverty level. The state Medicaid program pays their only Part B premium. Neither QMBs nor SLMBs are eligible for non-Medicare covered services.

- Medically Needy: Beneficiaries who do not meet income and asset requirements for SSI but incur catastrophic medical expenses. Medically needy beneficiaries are eligible for all Medicaid benefits offered by the state's program, including non-Medicare covered services such as nursing home care and prescription drugs.

- SSI and other full-Medicaid benefit dual eligibles: Beneficiaries who meet income and asset requirements to qualify for cash assistance under SSI. This group also includes people with other types of Medicaid eligibility determined by State rules. SSI recipients are eligible for full Medicaid benefits.

Many SSI eligibles are also identified as QMBs on the TP-EARTH file; we classified such people as SSI. The remaining, non-SSI QMBs are referred to as the 'QMB only', or 'OMB-onlies' category.

State Medicaid programs and buy-in rules vary substantially. In some states, Medicaid eligibility standards are the same as SSI eligibility standards, making all SSI recipients who are eligible for the Supplementary Medical Insurance (SMI or Medicare Part B) eligible for Medicaid and therefore eligible for Part B buy-in. In these states, all SSI recipients have Medicare buy-in. States with more restrictive eligibility standards for

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[8] The buy-in eligibility code of QMB in the TPEARTH file includes both QMB only and SSI recipients who were automatically bought-in based on SSI status. Additional information in the "accretion code" is needed to distinguish QMB onlies and SSI recipients with the same QMB code. SSI recipients who are automatically covered by QMB have the accretion code 80 and the buy-in eligibility code of QMB.

Medicaid than the SSI standards make their own Part B buy-in determinations. Some states provide full Medicaid benefits to QMBs and SLMBs. Also, based on their gross income, some medically needy and other noncash recipients may qualify as QMBs or SLMBs. However these 'full benefit' QMBs and SLMBs are not identified on the TP-EARTH file, so our 'QMB only' category may include some beneficiaries with full Medicaid benefits. States have the option to buy in for their Medical Assistance Only (MAO or medically needy group). Some states cover the MAO, but some do not. As a result, buy-in status does not include all Medicaid dual eligibles.

The completeness and accuracy of eligibility codes reported on the TP-EARTH file is of concern. The "buy-in eligibility code" is not a payment field, and is not used to determine states' Medicare premium liability. It is not audited or verified by HCFA. Comprehensiveness of reporting varies from state to state. On the advice of HCFA staff, we grouped persons with missing or state-specific eligibility codes with SSI eligibles. Table 2-4 presents distributions of missing eligibility code by state in 1995 and 1996. Nationwide, only 3.7% and 4.0% of eligibility codes were missing in 1995 and 1996, respectively. However, proportion of missing eligibility codes vary substantially across states. For instance, in 1995, 22.3% of eligibility codes were missing in North Carolina, while New Jersey had only 0.02% missing.

Table 2-5 presents distributions of Medicaid subgroups by state in 1995. The four Medicaid subgroups are not mutually exclusive, because one person may move from one subgroup to the other during a year. As a result, the sum of the percentages of Medicaid

subgroups exceeds 100% for each state. The results indicate that there is wide variation in the reported distribution of Medicaid subgroups among states. For example, the percent of QMB-onlies ranges from 0.67% in Alaska to 92.98% in Oklahoma, and the percentage of SSI/other ranges from under 5% in some states to over 80% in others. These variations seem too large to reflect actual programmatic differences among states, and rather appear to result from inaccuracies/incompleteness in coding eligibility categories.

Despite apparent inaccuracies and incompleteness in coding of Medicaid eligibility categories, we explored use of these categories for risk adjustment. Our assumption in doing so is that the categories contain some information that should be investigated despite the apparent ‘noise’. We created two types of Medicaid enrollment variables for each of the base year (1995) and the prediction year (1996). The first was counts of months each beneficiary was in each of the four types of Medicaid buy-in status during the year. The second was a single annual Medicaid indicator for any Medicaid enrollment (one or more months) during each year. Table 2-6 shows the distribution of Medicaid months in 1995 and 1996. Individuals with Medicaid buy-in status accounted for 14.8 percent and 15.5 percent of the study sample in 1995 and 1996, respectively. Of individuals with any Medicaid buy-in status in a year, the vast majority had a full 12 months of Medicaid coverage – 87 percent in 1995 and 83 percent in 1996. The lower percentage with 12 months of coverage in 1996 is because our sample includes decedents in 1996, but not 1995.

Table 2-7 displays movements in or out of Medicaid between 1995 and 1996. Among Medicare beneficiaries on Medicaid in 1995, 97.54% were still on Medicaid in 1996.

For beneficiaries without Medicaid in 1995, 1.24% went on Medicaid in 1996. Thus, a prospective measurement of Medicaid status (1995) is a good representation of concurrent (1996) Medicaid status.

2.3.3 Working Aged

Working aged is a demographic adjustment factor under the AAPCC methodology. Working aged is defined as aged beneficiaries with group health insurance coverage from their own or their spouse's employer.[9] Medicare is a secondary payer for the working aged. Each period of working aged status for each Medicare beneficiary is recorded on Medicare's enrollment database (EDB) using three fields: *Beneficiary Primary Payer Code*, *Primary Payer Entitlement Start Date*, and *Primary Payer End Date*. The working aged indicators are defined as the number of months with group health insurance in the base (1995) and prediction (1996) years, respectively.[10] The working aged are not included in the PIPDCG modelling sample, as discussed in Section 2.1. We use a second stage model to derive a multiplier for concurrent working aged status, as discussed later in this report

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[9] The Medicare enrollment file does not distinguish whether the group health insurance derives from a person's own employment, or from their spouse's employment, so this distinction cannot be used for risk adjustment.

[10] Only people with code = A (working aged beneficiary/spouse with employer group health plan) from the field *Beneficiary Primary Payer Code* are defined as working aged. We used beginning and end dates of each beneficiary with a primary payer code of A to derive number of months with group insurance.

Table 2-9 presents the age/sex distribution for people with working aged status in 1996.[11] In total, there are 15,461 Medicare beneficiaries with working aged status.[12] Men are more likely to be working aged than women (63% versus 37%). The majority of working aged are age 65 to 74. A small portion of working aged (1.4%) are age 85 or over.

The accuracy of HCFA's data on working aged status is a concern. Historically, these data may not have been collected in a comprehensive fashion. In particular, end dates for working aged status may not always have been identified, leading to an overstatement of working aged spells.[13] Because of the potential data quality problem related to open-ended working aged periods, we performed a sensitivity analysis of our definition of working aged. We imposed an end date of five years from the beginning date for open-ended working aged periods. We recounted the number of months with employer-based group insurance in 1996 using the new definition. Almost one-third of working aged (32%) would be redefined as non-working aged under the sensitivity analysis. Among this redefined group, 62.4% are in the 70-74 age group. The mean expenditure is $895 for this redefined group, which is very similar to the mean expenditure of people with 12 months of group insurance ($901) in the original definition. If there was a problem of failing to report end dates, we would expect

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[11] Persons have one month or more of employer-based group insurance. Age is defined as of 1/1/1996. Some persons who are age 64 on January 1 can be classified as working aged because they turn age 65 during 1996.

[12] After the file construction and much of the analysis was completed, we discovered an error in defining working aged status for people with overlapping working aged periods. As a result, 12 persons were misclassified as non-working-aged and were included in the PIPDCG model development rather than the working aged sample. This small missclassification should have negligible effect on our results.

[13] It is also possible that working aged spells are understated because some of the working aged with employer coverage may not be identified at all by HCFA. A (small) sample of HCFA's working aged information could be verified using the Medicare Current Beneficiary Survey, which contains independent questions on employment status and health insurance coverage. But that is beyond the scope of this project.

to observe a higher percentage of people in older age groups (such as, age 85 or more), or people with higher expenditures, to be reclassified as non-working aged in the sensitivity analysis. However, we did not observe this in the sensitivity analysis. Also, the age distribution for working aged shown in Table 2-8 accords with expectations.

On the other hand, we did find 382 working aged individuals with more working aged months than eligible months in 1996. In other words, the data indicates that these people are still working after death. This impossibility results from the open-ended working aged periods that caused us to assume that the individual was working throughout 1996. To resolve this problem, we restricted months of working aged status in 1996 to be no greater than months of eligibility.

We conclude that we find no evidence of major or systematic inaccuracies in HCFA's enrollment data used to assign working aged status, other than a failure to account for death. However, our effort to validate these data is limited. A more thorough validation of the data would be useful.

2.3.4 Diagnoses by Setting

The diagnostic classification system used in this project is based on all permissible codes from the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). Diagnostic information was classified into ten sources:

1. a principal inpatient diagnosis, which does not include principal diagnoses from SNFs, i.e., only principal inpatient diagnoses from PPS facilities and TEFRA (non-PPS) facilities and units are included (Table 2-9);

2. a non-principal (secondary) inpatient diagnosis (which also does not include SNFs);
3. hospital outpatient department (including emergency room visits);
4. physician;
5. clinically-trained non-physician;
6. facility types, such as nursing homes, SNFs, home health agencies;
7. diagnostic labs and imaging clinics;
8. medical supplies and DME;
9. hospices; and
10. other sources.

These categories were summarized in a variable called SOURCE. PIPDCG models use diagnoses with SOURCE codes of 1 or 2.[14]

Diagnoses from both header and line items were included for Medicare Part B records. For Part B line item diagnoses, we assigned the SOURCE code based on HCFA provider specialty code. The SOURCE code for header diagnoses of a Part B claim was based on the lowest numbered SOURCE of any line items on that claim. For example, if a claim's SOURCE codes from line items included 4, 5, and 6, then the SOURCE code for the header diagnoses is 4. In other words, physician sources take precedence over non-physician

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[14] PIPDCG models are designed to use principal inpatient diagnoses only. However, in two cases we use secondary diagnoses. In the case of chemotherapy as principal inpatient diagnosis we use secondary cancer diagnoses instead. And we classify people into the HIV/AIDS diagnostic category using both principal and secondary inpatient diagnoses. See Chapter 3 for details.

and facility sources when assigning the variable SOURCE to diagnoses that appear on the header of a Part B claim.

2.4 Comparisons of the 1991/1992 and 1995/1996 Samples

Tables 2-10 and 2-11 compare frequencies and mean Medicare payments in the 1991/1992 and 1995/1996 claims/enrollment samples by Medicare subgroup and by age/sex category, respectively. There are several changes in the frequencies of Medicare subgroups: the under-age-65 disabled population increased from 9.0% to 11.2% between the two time periods, the older elderly population (age 85 or over) increased from 10.5% to 11.4%, and the dual Medicare/Medicaid population increased from 12.8% to 14.7%. The last change is primarily due to the increase in the under-age-65 disabled dual eligible population, from 3.3% to 4.8%.

The mean Medicare payment increased from $3,778 in the 1991/1992 sample to $5,186 in the 1995/1996 sample. There are shifts in Medicare expenditures among subgroups. The disabled population appears to become less expensive, with a reduction in the ratio to the mean from 0.95 to 0.90 between the two periods. This could be related to more rapid growth in disabled enrollment, as less disabled/ill individuals become eligible for Medicare. The older elderly population became more expensive over time, with an increase in the ratio to the mean from 1.40 to 1.48. Perhaps this reflects more aggressive medical treatment of older individuals.

One should be aware that these two samples are not completely comparable in two respects. First, the sample definition is different between the two samples. The working aged and people entering hospices are included in the 1991/1992 sample, while they are excluded in the 1995/1996 sample. People who changed their Medicare Identification Numbers and Rail Road Retirees were excluded from the 1991/1992 sample, but were included in the 1995/1996 sample. Second, IME and hospice care payments are included in 1992 Medicare expenditures, while they are excluded from 1996 expenditures.

Table 2-1

Data Sources and Method of Measuring 1996 Expenditures[1]

Claims Type	Expenditure Definition
Part A[2]	
PPS Facilities[3]	DRG reimbursement including outlier, direct medical education and organ transplant payments
TEFRA (non-PPS) Facilities and Units[4]	Reported reimbursement
Skilled Nursing Facilities	Reported reimbursement
Home Health	Reported reimbursement
Part B[5]	
Physician and supplier services	Reported reimbursement
DME	Reported reimbursement
Hospital Outpatient Services	Reported reimbursement

Notes:

[1] Hospice claims were not included because HMOs are not responsible for hospice care. Indirect medical education payments are excluded. No claims were prorated across years. Coinsurance and deductibles are excluded.

[2] Expenditures were assigned to the date of discharge for inpatient admissions.

[3] Indirect medical education payments are excluded.

[4] Expenditures are not adjusted for the year end settlement which is a lump sum payment from Medicare to a TEFRA facility or vice versa.

[5] Expenditures were assigned to the "through date" for Part B claims. The "paid amount" is used to aggregate expenditures at the person level.

SOURCE: Health Economics Research, Inc.

Table 2-2

Distribution of Annualized Base 1996 Payments

Mean*	$5,186
Standard Deviation*	14,007
CV*	270
Standard Error*	13

Percentile	Annualized Payment
Max	$3,313,984
99	76,907
95	30,798
90	16,761
75	3,991
50	782
25	173
10	3
5	0
1	0
Min	0
% non-users (zero payments)	9.9%
% people died in 1996	4.8%

* Weighted by fraction of year alive. (Total number of distinct people = 1,387,105; number of person-years of entitlement = 1,352,500)

OUTPUT: DIAG99A, DIAG99B.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 2-3

Mean Annualized 1996 Expenditures by Study Sample

Mean Expenditure[1]	**PIPDCG Sample**[3] (n=1,387,105)	**PIPDCG Sample + Working Aged**[4] (n=1,406,542)	**PIPDCG Sample + Working Aged**[4] **+ Hospice in 1995**[5] (n=1,409,179)
Mean Base Expenditure[2]	$5,186	$5,140	$5,142
(standard error)	(13)	(12)	(12)
Mean of Base Expenditure plus IME	5,318	5,271	5,274
(standard error)	(13)	(13)	(13)
Mean of Base Expenditure plus IME and Hospice Payments	5,358	5,310	5,331
(standard error)	(13)	(13)	(13)

NOTES:

[1] Weighted by fraction of year alive.

[2] Base 1996 expenditures excludes indirect medical education (IME) and hospice payments and are used for PIPDCG modeling.

[3] The sample used for PIPDCG modeling.

[4] Working aged is defined as individuals with group insurance from their employer or spouse's employer any time during 1995 or 1996.

[5] Individuals entering hospices on or prior to January 1, 1996.

OUTPUT: DIAG99A

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare data.

Table 2-4

Percentage of Persons with Missing Medicaid Eligibility Code[1] by State from the TP-EARTH File

State	Percent with Missing Eligibility Code	
	1995	1996
Overall	3.68%	4.00%
Alabama	0.04	0.04
Alaska	1.67	1.33
Arizona	9.94	11.28
Arkansas	2.61	2.32
California	0.07	0.09
Colorado	11.84	17.08
Connecticut	11.13	9.87
Delaware	1.63	1.22
Dist of Columbia	0.91	1.19
Florida	2.57	1.28
Georgia	0.55	0.43
Hawaii	0.13	0.00
Idaho	0.30	0.00
Illinois	3.43	3.18
Indiana	0.50	0.34
Iowa	0.00	0.11
Kansas	5.93	5.22
Kentucky	0.15	0.19
Louisiana	0.91	0.89
Maine	2.15	1.83
Maryland	8.23	8.86
Massachusetts	2.46	2.23
Michigan	5.39	4.09
Minnesota	0.51	0.60
Mississippi	0.15	0.13
Missouri	12.41	11.48
Montana	0.19	0.18
Nebraska	15.59	14.62
Nevada	7.36	7.58

Table 2-4 (continued)

Percentage of Persons with Missing Medicaid Eligibility Code[1] by State from the TP-EARTH File

	Percent with Missing Eligibility Code	
State	1995	1996
New Hampshire	1.41	1.34
New Jersey	0.02	0.07
New Mexico	0.15	0.22
New York	8.18	8.29
North Carolina	22.31	22.50
North Dakota	0.00	0.38
Ohio	18.87	27.45
Oklahoma	0.10	0.20
Oregon	0.16	0.00
Pennsylvania	0.43	0.23
Rhode Island	1.59	1.26
South Carolina	0.12	0.07
South Dakota	0.32	0.30
Tennessee	0.43	0.44
Texas	0.12	0.05
Utah	1.94	1.42
Vermont	0.33	0.16
Virgin Islands[2]	100.00	100.00
Virginia	0.22	0.19
Washington	0.09	0.09
West Virginia	0.20	0.28
Wisconsin	0.05	0.05
Wyoming	0.00	0.00
Guam[2]	0.00	0.00

NOTE:

[1] Persons with missing eligibility codes are assigned to the subgroup of SSI and other.

[2] The sample excludes beneficiaries with state of residence outside the 50 states and Washington DC during 1995 and 1996 based on the Medicare enrollment file. However, a few people appeared residing in the excluded areas based on the state code on the TP-EARTH file.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare data.

OUTPUT: DIAG99E

Table 2-5

Distribution of Medicaid Subgroups[1] by State in 1995 from the TP-EARTH File

State	Total Number	Percent QMBs[2]	Percent SLMBs[3]	Percent Medically Needy	Percent SSI & Other[4]
National	205,635	34.57%	4.59%	7.15%	57.91%
Alabama	60,764	24.28	4.87	3.80	68.74
Alaska	3,434	0.67	0.00	0.00	100.00
Arizona	17,620	26.77	1.56	0.19	74.79
Arkansas	42,287	28.81	5.30	7.67	59.73
California	293,183	9.57	1.46	16.49	77.44
Colorado	22,453	20.71	0.05	16.12	65.19
Connecticut	26,885	84.92	4.58	0.00	11.58
Delaware	4,106	18.75	3.53	0.00	79.08
Dist of Columbia	7,696	2.44	6.09	0.15	92.85
Florida	132,335	33.10	2.35	9.64	58.24
Georgia	87,037	27.78	4.40	12.12	59.14
Hawaii	8,630	24.57	0.40	35.99	40.90
Idaho	7,243	61.93	3.78	22.51	16.31
Illinois	66,338	88.69	8.59	0.00	3.90
Indiana	41,530	66.71	13.47	19.26	2.63
Iowa	27,750	42.24	13.33	19.20	36.41
Kansas	17,982	35.21	3.73	7.21	55.26
Kentucky	52,222	33.59	6.33	0.04	62.13
Louisiana	57,035	24.31	3.27	0.02	72.84
Maine	15,983	37.76	6.25	0.00	59.15
Maryland	31,342	90.63	2.48	2.01	8.84
Massachusetts	67,370	32.15	8.60	0.02	64.85
Michigan	65,042	30.51	10.01	6.79	58.87

Table 2-5 (continued)

Distribution of Medicaid Subgroups[1] by State in 1995 from the TP-EARTH File

State	Total Number	Percent QMBs[2]	Percent SLMBs[3]	Percent Medically Needy	Percent SSI & Other[4]
Minnesota	27,904	41.13	5.56	0.00	56.74
Mississippi	59,807	32.81	3.44	12.50	54.81
Missouri	37,117	80.10	6.26	0.03	14.87
Montana	5,737	42.94	8.90	0.00	52.03
Nebraska	8,840	15.10	1.73	0.12	84.03
Nevada	6,554	76.42	7.53	9.53	9.20
New Hampshire	3,180	26.86	0.00	0.00	73.85
New Jersey	59,942	35.49	8.84	14.30	44.08
New Mexico	14,698	22.39	4.65	11.77	62.82
New York	137,360	18.01	0.19	0.01	85.78
North Carolina	103,681	6.63	4.90	0.77	88.89
North Dakota	2,858	22.96	5.84	0.00	73.54
Ohio	88,201	54.06	5.50	20.56	20.39
Oklahoma	33,215	92.98	6.54	0.03	1.78
Oregon	13,809	63.68	8.33	10.63	20.38
Pennsylvania	86,883	38.85	5.14	0.00	60.38
Rhode Island	7,913	14.60	0.29	0.00	85.69
South Carolina	49,476	42.21	3.57	5.07	52.56
South Dakota	6,901	39.49	9.31	0.00	52.17
Tennessee	85,184	43.44	0.03	0.03	57.29
Texas	164,811	29.60	4.13	0.01	67.99
Utah	7,350	62.99	7.31	30.75	2.69
Vermont	6,941	26.59	14.19	0.49	61.34
Virgin Islands[5]	43	0.00	0.00	0.00	100.00
Virginia	55,041	44.09	4.63	7.45	45.49

Table 2-5 (continued)

Distribution of Medicaid Subgroups[1] by State in 1995 from the TP-EARTH File

State	Total Number	Percent QMBs[2]	Percent SLMBs[3]	Percent Medically Needy	Percent SSI & Other[4]
Washington	35,061	23.74	5.54	32.25	43.82
West Virginia	23,065	40.41	6.38	0.05	57.18
Wisconsin	40,513	28.21	7.54	0.03	68.46
Wyoming	2,831	37.98	10.85	6.98	46.12
Guam[5]	12	0.00	0.00	0.00	100.00

NOTE:

[1] Medicaid subgroups are not mutually exclusive, because a person can move from one subgroup to another in a year. As a result, the sum of the percentages of subgroups exceeds 100%.

[2] Qualified Medicare Beneficiaries only ('QMB-onlies').

[3] Specified Low-Income Medicare Beneficiaries.

[4] Includes persons with missing eligibility codes.

[5] The sample excludes beneficiaries with state of residence outside the 50 states and Washington DC during 1995 and 1996 based on the Medicare enrollment file. However, a few people appeared residing in the excluded areas based on the state code on the TP-EARTH file.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare data.

OUTPUT. DIAG99E

Table 2-6

Distribution of Medicaid Months in 1995 and 1996

			Cumulative	
Medicaid Months in 1995	Frequency	Percent	Frequency	Percent
1	1,664	0.8	1,664	0.8
2	1,852	0.9	3,516	1.7
3	2,163	1.1	5,679	2.8
4	2,049	1.0	7,728	3.8
5	2,039	1.0	9,767	4.7
6	2,327	1.1	12,094	5.9
7	2,170	1.1	14,264	6.9
8	2,226	1.1	16,490	8.0
9	2,583	1.3	19,073	9.3
10	2,613	1.3	21,686	10.5
11	2,778	1.4	24,464	11.9
12	181,171	88.1	205,635	100.0

			Cumulative	
Medicaid Months in 1996	Frequency	Percent	Frequency	Percent
1	3,359	1.6	3,359	1.6
2	3,372	1.6	6,731	3.1
3	3,375	1.6	10,106	4.7
4	3,103	1.4	13,209	6.1
5	3,064	1.4	16,273	7.6
6	3,099	1.4	19,372	9.0
7	3,222	1.5	22,594	10.5
8	3,241	1.5	25,835	12.0
9	3,331	1.5	29,166	13.5
10	3,691	1.7	32,857	15.3
11	3,589	1.7	36,446	16.9
12	178,805	83.1	215,251	100.0

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare data.

OUTPUT: DIAG99Q.OUT

Table 2-7

Movements In or Out of Medicaid Between 1995 and 1996[1]

	Medicaid 1995		
Medicaid 1996	No	Yes	Total
Total	1,181,470 (100.0%)	205,635 (100.0%)	1,387,105
No	1,166,793 (98.76%)	5,061 (2.46%)	1,171,854
Yes	14,677 (1.24%)	200,574 (97.54%)	215,251

NOTE:

[1] Medicaid status is defined using the TP-EARTH file.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare data.

OUTPUT: DIAG99Q.OUT

Table 2-8

Age[1] and Sex Distribution for People with Working Aged Status[2] in 1996

	Number of 1996 Working Aged People	Percent of Total
Male 64	157	1.02 %
65-69	4,766	30.83
70-74	3,043	19.68
75-79	1,314	8.50
80-84	362	2.34
85-89	100	0.65
90-94	25	0.16
95+	2	0.01
Female 64	51	0.33
65-69	2,770	17.92
70-74	1,847	11.95
75-79	730	4.72
80-84	207	1.34
85-89	68	0.44
90-94	16	0.10
95+	3	0.02
Total	15,461	100.00

NOTE:

[1] Age as of January 1, 1996. Persons age 64 on January 1 can turn 65 later in the year and be in working aged status.

[2] Including people with one month or more of employer-based group insurance.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare data.

OUTPUT: DIAG99QC.OUT

Table 2-9

Sources of Principal Inpatient Diagnoses (PIPs)

Data Source	Inclusion of PIPs
PPS Facilities	yes
TEFRA (non-PPS) Facilities and Units Including psychiatric, rehabilitation, long-term care, children's and other specialty hospitals	yes
Skilled Nursing Facilities or Units	no

SOURCE: Health Economics Research, Inc.

Table 2-10

Comparisons of Frequencies and Mean Payments for Medicare Subgroups Between 1991/1992 and 1995/1996 Samples

Subgroup	1991/1992 Sample[1]				1995/1996 Sample[2]			
	N	Percent of Total Sample	Mean 1992 Payments[3]	Ratio to the Mean	N	Percent of Total Sample	Mean 1996 Base Payments[4]	Ratio to the Mean
Overall Sample	1,360,626	100.0%	$3,778	1.00	1,387,105	100.0%	$5,186	1.00
Disabled (age <= 64)	122,443	9.0	3,586	0.95	154,784	11.2	4,636	0.89
Younger disabled (age <= 44)	43,686	3.2	3,010	0.80	55,579	4.0	3,846	0.74
Older disabled (age 45 - 64)	78,757	5.8	3,909	1.03	99,205	7.2	5,082	0.98
Aged (age >= 65)	1,238,183	91.0	3,779	1.00	1,232,321	88.8	5,256	1.01
Ever disabled	85,618	6.3	5,585	1.48	87,154	6.3	7,966	1.54
Younger elderly (age 65 - 84)	1,095,779	80.5	3,612	0.96	1,073,853	77.4	4,917	0.95
Older Elderly (age 85+)	142,404	10.5	5,298	1.40	158,468	11.4	7,685	1.48
Medicaid*	174,336	12.8	5,499	1.46	204,267	14.7	7,290	1.41
Disabled (age <= 64)	45,347	3.3	4,384	1.16	66,370	4.8	5,556	1.07
Elderly (age >= 65)	128,989	9.5	5,906	1.56	137,897	9.9	8,161	1.57
Non-Medicaid	1,186,290	87.2	3,529	0.93	1,182,838	85.3	4,828	0.93
Disabled (age <= 64)	77,096	5.7	3,116	0.82	88,414	6.4	3,944	0.76
Elderly (age >= 65)	1,109,194	81.5	3,558	0.94	1,094,424	78.9	4,901	0.95
Female	798,732	58.7	3,626	0.96	812,354	58.6	5,098	0.98
Male	561,894	41.3	3,995	1.06	574,760	41.4	5,310	1.02

NOTES:

*Medicaid status is defined using the Medicaid buy-in indicator from the denominator files.

[1] Including working aged in both 1991 and 1992, and people entering hospices in 1991; excluding people who changed their Medicare Identification Numbers and RailRoad Board Retirees

[2] Excluding working aged in 1995 and 1996, and people entering hospices in 1995; including people who changed their Medicare Identification Numbers and RailRoad Board Retirees

[3] Including IME and Hospice payments.

[4] Excluding IME and Hospice payments.

OUTPUTS RUN001A, RUN007A

SOURCE Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 2-11

Comparisons of Frequencies and Mean Payments by Age/Sex Category Between 1991/1992 and 1995/1996 Samples

	1991/1992 Sample[1]				1995/1996 Sample[2]			
	N	Percent of Total Sample	Mean 1992[3] Payments	Ratio to the Mean	N	Percent of Total Sample	Mean 1996[4] Base Payments	Ratio to the Mean
Overall Sample	1,360,626	100.0%	$3,778	1.00	1,387,105	100.0%	$5,186	1.00
Female, 0-5	0	0.0	0	0.00	1	0.0	42,742	8.24
Female, 6-12	1	0.0	1,155	0.31	1	0.0	590	0.11
Female, 13-17	0	0.0	0	0.00	0	0.0	0	0.00
Female, 18-24	747	0.1	2,623	0.69	943	0.1	2,937	0.57
Female, 25-34	5,376	0.4	3,250	0.86	6,660	0.5	3,843	0.74
Female, 35-44	9,661	0.7	3,292	0.87	13,370	1.0	4,192	0.81
Female, 45-54	10,874	0.8	3,860	1.02	16,998	1.2	4,653	0.90
Female, 55-64	20,120	1.5	4,676	1.24	24,793	1.8	6,223	1.20
Female, 65-69	176,217	13.0	2,563	0.68	157,932	11.4	3,492	0.67
Female, 70-74	197,783	14.5	3,123	0.83	194,736	14.0	4,228	0.82
Female, 75-79	159,865	11.7	3,854	1.02	160,073	11.5	5,241	1.01
Female, 80-84	113,462	8.3	4,462	1.18	120,367	8.7	6,350	1.22
Female, 85-89	66,458	4.9	4,999	1.32	73,101	5.3	7,315	1.41
Female, 90-94	28,380	2.1	5,295	1.40	32,394	2.3	7,708	1.49
Female, 95+	9,788	0.7	4,860	1.29	10,976	0.8	7,398	1.43
Female, 95-99	8,268	0.6	5,074	1.34	9,021	0.7	7,749	1.49
Female, 100-104	1,313	0.1	4,104	1.09	1,613	0.1	6,544	1.26
Female, 105+	207	0.0	1,274	0.34	342	0.0	2,222	0.43

Table 2-11 (continued)

Comparisons of Frequencies and Mean Payments by Age/Sex Category Between 1991/1992 and 1995/1996 Samples

	1991/1992 Sample[1]				1995/1996 Sample[2]			
	N	Percent of Total Sample	Mean 1992[3] Payments	Ratio to the Mean	N	Percent of Total Sample	Mean 1996[4] Base Payments	Ratio to the Mean
Male, 0-5	0	0.0	0	0.00	1	0.0	135	0.03
Male, 6-12	0	0.0	0	0.00	2	0.0	161	0.03
Male, 13-17	0	0.0	0	0.00	1	0.0	851	0.16
Male, 18-24	1,173	0.1	1,932	0.51	1,509	0.1	2,387	0.46
Male, 25-34	9,805	0.7	2,904	0.77	10,890	0.8	3,653	0.70
Male, 35-44	16,923	1.2	2,927	0.77	22,201	1.6	3,872	0.75
Male, 45-54	18,207	1.3	3,095	0.82	25,288	1.8	4,128	0.80
Male, 55-64	29,556	2.2	3,975	1.05	32,126	2.3	5,184	1.00
Male, 65-69	140,553	10.3	3,073	0.81	126,489	9.1	4,008	0.77
Male, 70-74	145,354	10.7	3,750	0.99	143,951	10.4	4,877	0.94
Male, 75-79	103,131	7.6	4,698	1.24	104,937	7.6	6,066	1.17
Male, 80-84	59,414	4.4	5,269	1.39	65,368	4.7	7,169	1.38
Male, 85-89	26,808	2.0	5,867	1.55	29,953	2.2	8,165	1.57
Male, 90-94	8,736	0.6	6,217	1.65	9,703	0.7	9,041	1.74
Male, 95+	2,234	0.2	6,033	1.60	2,341	0.2	8,993	1.73
Male, 95-99	1,945	0.1	6,251	1.65	1,996	0.1	9,445	1.82
Male, 100-104	249	0.0	5,156	1.36	283	0.0	7,833	1.51
Male, 105+	40	0.0	1,187	0.31	62	0.0	699	0.13

NOTES:

[1] Including working aged in both 1991 and 1992, and people entering hospices in 1991; excluding people who changed their Medicare Identification Numbers and RailRoad Board Retirees.

[2] Excluding working aged in 1995 and 1996, and people entering hospices in 1995; including people who changed their Medicare Identification Numbers and RailRoad Board Retirees.

[3] Including IME and Hospice payments.

[4] Excluding IME and Hospice payments

OUTPUT: RUN004A

SOURCE: Health Economics Research, Inc analysis of 1995 and 1996 Medicare claims data.

Appendix 2-A

PPS Graduate Medical Education (GME) Payments on MedPAR Records

The Balanced Budget Act of 1997 specifies that Medicare payments for Graduate Medical Education (GME) should be excluded from capitation rates paid to Medicare risk contractors, and instead paid directly to teaching hospitals. Therefore, ideally, the risk adjustment weights, which are used to adjust capitation payments, should be derived from Medicare payments excluding hospital medical education payments. This appendix discusses the medical education payments issue in depth. We first discuss the components and magnitude of GME payments to hospitals. Then we discuss medical education payment policy, both pre- and post-BBA (note that our 1996 expenditure data is pre-BBA). After that, we discuss how (interim) GME payments are recorded on MedPAR claims, and what would be involved in removing them from total payments.

Medicare PPS GME Payments

Under Medicare PPS, there are two GME payment components: direct medical education (DME) and indirect medical education (IME). Interim DME payments are made to hospitals at regular dates during the year while interim IME payments are made on a per discharge basis. The Medicare Fiscal Intermediaries (FIs) base these interim payments on the expected number of FTE residents and the anticipated resident-to-bed ratio. The actual number of FTE residents and the actual resident-to-bed ratio are not known until the completion of a fiscal year. Final GME amounts for each hospital are determined when

hospitals submit their *Medicare Cost Report* (MCR). Interim GME shortfalls and overpayments are, thus, reconciled when the MCR is "accepted" by HCFA. However, the interim amounts on the MedPAR claims are not adjusted to be consistent with the final reconciled amount for each hospital. Thus, to remove GME from the MedPAR records, it is interim, not final payments, that must be removed.

In fiscal year 1997, DME payments were about $2.3 billion, a 53% increase over the $1.5 billion in 1990 payments.[1] IME payments increased 92% between 1990 and 1997 from $2.5 billion to about $4.8 billion. In 1997, IME payments accounted for 5.4% of total Medicare inpatient hospital payments and 5.9% of total PPS payments while DME payments accounted for 2.6% of total Medicare inpatient hospital payments and 2.9% of total PPS payments. "The key factor driving Medicare's educational payments upward was a national increase of 26.4 percent in the number of residents in training between 1989 and 1996."[2]

PPS Payment Policy

Pre-1997 BBA. Prior to the 1997 BBA, annual DME payments under PPS were equal to the product of the number of qualifying FTE residents, the per payment resident amount, and Medicare's share of inpatient days. The IME adjustment factor for the operating payment portion of each PPS discharge is given by the following formula:

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[1] 1997 GME amounts derived from Figure 27 (see attached) in HCFA's *1998 Chart Book*, available at HCFA's website. 1990 GME amounts derived from: John Iglehart, "Medicare and Graduate Medical Education," *New England Journal of Medicine* 338:6 (February 5, 1998), pp. 402-407.

[2] Iglehart, *Ibid.*

$$IME = \left[\left(1 + \frac{\text{Resident}}{\text{Beds}} \right)^{0.405} - 1 \right] \times 1.89 \qquad (1)$$

where the 1.89 is known as the IME *multiplier factor*. A resident-to-bed ratio of 0.1 results in an IME adjustment factor of 0.0744. The IME adjustment for outlier payments is the same as for non-outlier payments. For capital payments, an IME adjustment is used to help derive the capital Federal rate. However, since there is a ten-year transition period (beginning in FY92) for capital payments, not all capital payments to teaching hospitals have an explicit IME adjustment. That is, for capital, hospitals receive a blended amount comprised of capital paid on a pass-through basis and a prospective amount.[3] Only the prospective amount has an explicit IME adjustment. The IME adjustment formula used in helping derive the adjusted Federal capital rate is:[4]

$$IME = e^{0.2822 \times \frac{\text{Residents}}{ADC}} - 1 \qquad (2)$$

where ADC is the average daily census. A resident-to-ADC ratio of 0.1456 results in an IME capital adjustment factor of 0.0419.

For operating, outlier, and Federal capital payments, the IME adjustment is used as follows:

$$\text{Total payment} = (\text{base amount including case-mix and geographic adjustments}) \times (1 + IME). \qquad (3)$$

Prior to the enactment of the 1997 BBA, GME was included in HMO AAPCC rates.

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[3] Medicare capital payment policy is much more complicated than hinted here. We are just highlighting the portions relevant to IME payments.

[4] *Federal Register* 56:169 (August 30, 1991), p. 43380.

1997 BBA Provisions. The BBA did not change the IME adjustment formula for capital-related costs. However, "Beginning in FY1998, IME and DSH payments will be made only on the base DRG payment rates and not on outlier payments. In determining outlier payments, the fixed loss cost outlier threshold will encompass payments for IME and DSH. (Section 4405)."[5] The multiplier factor was reduced from 1.89 to 1.72 for base DRG payments for discharges after September 30, 1997. The multiplier factor will be further reduced, in annual steps, to 1.35 for fiscal year 2001 and thereafter. The BBA caps the number of FTE residents for each teaching hospital to no higher than the hospital's December 1996 value. The BBA also caps the resident-to-bed ratio for each teaching hospital to no higher than the hospital's December 1996 value.[6]

As part of the wide-ranging changes to HMO payment rates, Section 1853 of the BBA stipulates that GME payments will be carved out of the area-specific (AAPCC) base rate, "on the following schedule: 20 percent in 1998, 40 percent in 1999; 60 percent in 2000; 80 percent in 2001; and 100 percent in 2002 and thereafter."[7] Sections 4622 and 4624 of the new Medicare+Choice BBA provisions in the 1997 BBA provide for GME payments to hospitals for treating enrollees in Medicare+Choice plans.

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[5] *Federal Register* 62:168 (August 29, 1997), p. 45968.

[6] All other BBA changes in this paragraph can be found in *Ibid.*, p. 46003.

[7] Quoted from page 19 of HCFA's summary of the 1997 BBA provisions – obtained from HCFA's website.

GME Payment Amounts on MedPAR Records

Our MedPAR documentation references are to the 500-byte version pertaining to 1987-March 1995. It has been our experience that more recent MedPAR data still uses this old record layout even though we have a set of MedPAR documentation that claims it should be used with all post-1995 MedPAR data.

To arrive at total Medicare "payments" on a MedPAR record for a PPS discharge, total pass-through costs must be added to the *Amount Reimbursed* field (Field No. 50). Total pass-through costs can be found in the field confusingly-titled, *Bill Total per Diem* (Field No. 43). Pass-through costs include own-capital costs, DME, organ acquisition costs, bad debt, and miscellaneous other costs. The amount reimbursed field does not include the pass-through costs but does include all other payment amounts, including outlier, IME, DSH, and PPS capital amounts as well as the base payment amount.

The IME payment amount field (No. 41) includes IME payments for both the DRG base payment and outlier amounts. It, therefore, is easy to subtract this IME payment amount from total Medicare payments. As noted by Stephen Phillips (HCFA) in an e-mail to HER, the IME amount for capital payments is combined in the *PPS Capital Total Amount* field (No. 44). It can be estimated using the following steps: (1) estimate the resident-to-ADC ratio, (2) divide the value in the PPS Capital total amount field by (1 + resident/ADC) to obtain the "base amount" in Equation 3, and (3) multiply the base amount by the resident/ADC ratio to obtain the IME portion of PPS capital payments. There does not seem

to be any easy way to impute implicit IME "payments" on the pass-through portion of capital payments.

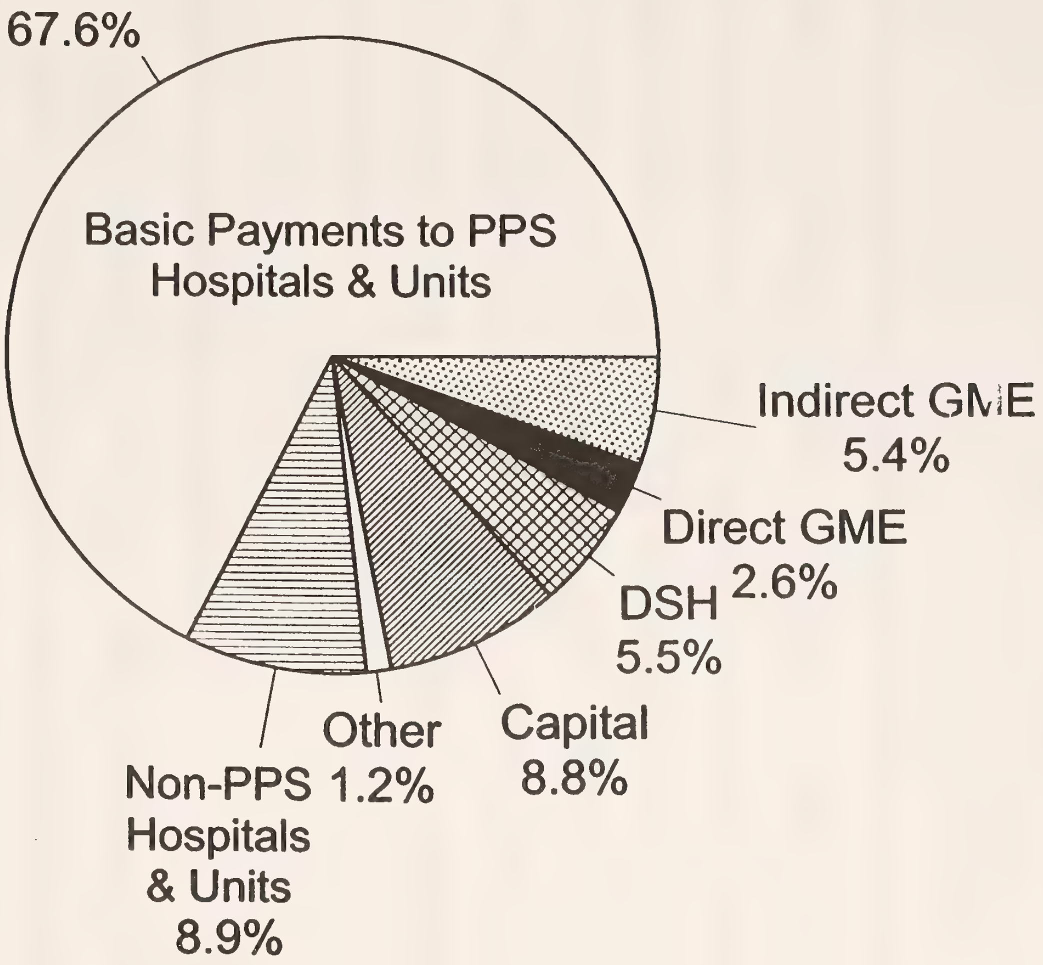
It may not be necessary to remove either IME capital payment amount from total Medicare payments because, as noted by Stephen Phillips in an e-mail to HER, "capital IME is not being carved-out of the AAPCC, nor is it being paid directly to hospitals. Therefore, the rationale for removing operating IME and direct GME (these payments are going directly to hospitals and should be completely removed from managed care payment calculations) does not exist for capital IME, and it should be left in, at least for the time being."

According to Stephen Phillips in an e-mail to HER, "one method used by some FIs to determine DME is to calculate a DME per diem amount, by dividing the prior cost reporting periods DME payments by Medicare days. Then, as each bill comes in, this per diem is multiplied by the covered days on the bill. This is used as an alternative to simply dividing the FI's best estimate of total DME payments for the year (based again on last year) into 26 biweekly payment amounts. Both methods are then subject to settlement with the cost report." To impute the DME amount for each MedPAR record, the per diem DME amount should be multiplied by the number of covered days on the MedPAR record. To calculate the per diem DME, it is necessary to obtain ancillary information from MCRs submitted by hospitals. If DME imputations are undertaken, the imputed amount should not be allowed to exceed the total value of the pass-through costs field. It will also be necessary to ascertain the imputation methods used by other FIs.

In sum, removing the relevant, non-capital portion of IME from total Medicare hospital payments is straightforward. The IME payment field is simply subtracted. Total IME represents about two-thirds of total capital payments. Removing DME is considerably more involved. The MCRs must be accessed, then merged with the hospitals on our DCG files. Also, the method that each FI used to compute interim DME amounts for 1996 bills must be discovered, or estimated.

DISTRIBUTION OF MEDICARE INPATIENT HOSPITAL PAYMENTS, FY 1997

Total Medicare Inpatient Hospital Payments, FY 1997 = $88.9 billion



Source: HCFA/Office of the Actuary.

Figure 27

3

Diagnostic Classification

This chapter discusses the diagnostic classification that forms the basis of our risk adjustment models. The first section, 3.1, describes the reasons for revising our previous diagnostic classification (Ellis *et al*., 1996). In Section 3.2 we discuss the rationale for excluding certain diagnoses from a model version to be used for setting payments. Section 3.3 describes the process and results of diagnostic grouping and exclusions.

Section 3.4 presents evidence and recommendations for handling admissions for chemotherapy in the payment models. Finally, Section 3.5 discusses the treatment of HIV/AIDS in the payment models.

3.1 Need for Revision of Diagnostic Groupings

The basis of the Diagnostic Cost Group (DCG) diagnostic classification is the Diagnostic Group, or DxGroup. DxGroups are diagnostic categories comprising specified International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic codes. DxGroups formed using principal inpatient diagnostic codes are called PIP-DxGroups, or PIPDxGs for short. An example is PIPDxG 1, Central Nervous System Infections, which includes ICD-9-CM codes for encephalitis, meningitis, etc. The primary criteria used in forming PIPDxGs are clinical coherence and adequate sample size to estimate

mean medical costs accurately (see Ash *et al.*, 1989; Ellis and Ash, 1995; and Ellis *et al.*, 1996 for further discussion).

In our most recent work for HCFA on models that use only inpatient data (Ellis *et al.*, 1996), we defined 143 PIPDxGs, which formed the starting point for this project. The PIPDxGs needed review and revision for several reasons. First, in recent work for HCFA on Medicare and under-age-65 populations (Pope *et al.*, 1998a; Ash *et al.*, 1998) we defined many additional diagnostic categories for use with diagnoses obtained in a range of settings: principal inpatient, secondary inpatient, physician and other ambulatory. These DxGroups are known as AD-DxGroups for "all diagnoses DxGroups", or ADDxGs for short. Because many people diagnosed in ambulatory settings are never admitted to the hospital, there are many more ADDxGs than PIPDxGs. That is, a much broader range of common problems are addressed in all settings, permitting a much finer ADDxG diagnostic classification than PIPDxG classification. Currently, 543 ADDxGs comprise the DCG diagnostic classification. Each ADDxG is assigned to one and only one PIPDxG. This assignment needed review, because recent work had focused on diagnoses in all settings, not principal inpatient diagnoses. In particular, many new ADDxGs relevant to the diagnoses of under-age-65 populations (e.g., pregnancy, neonatal, pediatric) were created that needed to be assigned to clinically coherent PIPDxGs.

A second reason for review of the PIPDxGs was the availability of 1995-1996 Medicare expenditure data for this project. Technology and treatment patterns can change over time, modifying the relative costliness of diagnoses and requiring periodic review and

adjustment of diagnostic groupings. Also, ICD-9-CM codes are revised annually (mostly new ones are created), creating the need to adjust of diagnostic categories.

A third reason for review of the PIPDxGs was to define for this project a payment version of the Principal Inpatient Diagnostic Cost Group, or PIPDCG, model. As discussed in the next section, certain PIPDxGs are excluded from the payment version. In refining the PIPDxGs, we needed to separate diagnoses to be included versus excluded into distinct PIPDxGs.

3.2 Rationale for Exclusion of Diagnoses from Payment Model

The PIPDxGs comprise an exhaustive classification of all valid ICD-9-CM codes, including "V" codes, which indicate procedures and other miscellaneous health factors, and "E" codes, a supplemental classification of injuries and poisonings. However, it is not desirable to risk adjust capitation payment rates for all possible principal inpatient diagnoses. Attaching higher future capitation payments to principal inpatient diagnoses establishes incentives to admit patients to the hospital. When all diagnoses are included in a risk adjustment model used to set payments, plans that hospitalized more are automatically rewarded for that. Especially because substantial variations exist among health plans and geographic areas in rates of hospital admission, excluding minor or nonspecific diagnoses that do not clearly require hospital care from the payment model is expected to improve its fairness. Such exclusions are intended to reduce the systematic penalty to efficient health

plans that is inherent in inpatient-based risk adjustment methods, which identify sickness only when there is a hospital admission.

The fundamental goal of risk adjusted payments is to reflect the relative health cost burden of populations as accurately as possible while maintaining incentives for appropriate treatment of individuals. Unlike a unit-of-payment system such as Diagnosis-Related Groups (DRGs), the aim is not to pay providers the expected cost of instances of care (such as each hospital admission). By excluding minor and nonspecific diagnoses, risk adjustment focuses on measuring the burden of high-cost, chronic illness.

Thus, we established the following principles for including/excluding diagnoses from the payment version of the PIPDCG model. Diagnostic categories should be included in the payment model if they:

- represent a clearly defined and clinically significant disease, disorder, state, or event;
- often require inpatient hospital care; and
- predict higher future medical cost.

Diagnostic categories should be excluded if they:

- can be a minor or transitory disease or disorder; or
- are rarely the principal reason for inpatient hospital care; or
- can be vague or ambiguous.

These criteria do not define an automatic decision algorithm, since some diagnostic categories have “contradictory” attributes; that is they satisfy both inclusion and exclusion “criteria.” In these situations we used clinical and policy-conscious judgment to arrive at a decision about inclusion or exclusion.

3.3 Process and Results of Diagnostic Grouping and Exclusion

In our review of the PIPDxGs in this project, we restricted ourselves to changing how ADDxGs are assigned to PIPDxGs. We did not make any changes to the ICD-9-CM codes assigned to ADDxGs, as defined in Pope *et al.*, 1998a and Ash *et al.*, 1998. Various information, shown in Appendix Table A-4, was prepared to support the review of the PIPDxGs and to identify diagnostic groups to exclude from the payment model[1]:

- the most recent assignment of ADDxGs to PIPDxGs (Ellis *et al.*, 1996);
- diagnoses (ADDxGs) excluded from the most recent DCG/HCC model (Pope *et al.*, 1998a; Ash *et al.*, 1998);
- diagnoses had been rated by a panel of three physicians as being associated with ambiguous or discretionary hospital admissions, by ADDxG (Ellis and Ash, 1988);
- number of people (frequency) with a principal inpatient diagnosis in this group in 1995 by PIPDxG and ADDxG;
- 1996 mean Medicare payments for people with a principal inpatient diagnosis in this group in 1995, by PIPDxG and ADDxG;
- number of people (frequency) with a diagnosis in this group in 1995 in any setting[2];
- 1996 mean Medicare payments for people with the diagnosis in any setting in 1995, by ADDxG;
- the admission rate per 1,000 cases diagnosed, defined as people with a 1995 principal inpatient diagnosis per 1,000 occurrences of the diagnosis in any setting in 1995, by ADDxG;

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[1] Some data in Table A-4 is preliminary, and is not necessarily exactly consistent with the final data presented elsewhere in this report.

[2] 'Any' settings consist of principal hospital inpatient, secondary hospital inpatient, hospital outpatient, physician, and clinically-trained non-physician.

- the Diagnostic Cost Group from the PIPDCG sorting algorithm (see Chapter 4), with and without exclusions, by PIPDxG; and
- the percentage of 1995 hospitalizations with a length of stay of zero or one days, and mean 1996 payments for individuals with these short stays, by PIPDxG.

In summary, Table A-4 provides frequencies and costs of diagnoses in both inpatient and "all" settings, admission rates per 1,000 cases diagnosed, and the results of previous deliberations about which diagnoses should be included in payment models.

Table A-4 was reviewed and revised by the physician authors of this report at several meetings with project staff. The number of PIPDxGs was increased from 143 to 172,[3] with many PIPDxGs added in the pregnancy/neonatal/pediatric area. For example, the single PIPDxG 115 for pregnancy was split into 7 new PIPDxGs. Since Medicare sample sizes are very small for these diagnoses, the categories followed the Hierarchical Coexisting Conditions (HCC) groupings developed for non-Medicare younger populations, as developed in Ash *et al.*, 1998. Some splits were because of cost differences. For example, PIPDxG 7 was split into one PIPDxG for liver/pancreas/esophagus cancer and a second for stomach/small bowel/other digestive cancer because the former is significantly more costly. Other splits were made because of clinical significance and frequency in the Medicare population. For example, hyperplasia of prostate was separated from other disorders of the male genital organs.

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[3] The count 172 includes only PIPDxGs assigned using diagnoses. There is also a PIPDxG 0, which includes people with no inpatient admissions (in 1995), and a PIPDxG -1, which includes people with numerically invalid principal inpatient diagnoses. Including these two categories, the total number of PIPDxGs is 174.

Some ADDxGs were moved between existing PIPDxGs. For example, ADDxG 33.01, Pyloric/Duodenal Obstruction, was moved from PIPDxG 33, Stomach Disorders, to PIPDxG 38, Gastrointestinal Obstruction/Perforation, because it the latter category is clinically more appropriate. The PIPDxG assignments of all ADDxGs defined in recent work (Pope *et al.*, 1998a; Ash *et al.*, 1998) were reviewed and in some cases changed. For example, ADDxG 21.08, Polycythemia Vera, was moved from PIPDxG 21, Neoplasm of Uncertain Behavior, to PIPDxG 51, Blood/Immune Disorders.

Exclusions of PIPDxGs from the payment model were made in accordance with the principles set forth in Section 3.2 above. Altogether 75, or 44 percent, of the 172 PIPDxGs are excluded from the payment model (97 PIPDxGs are included). Several types of diagnoses were excluded, illustrated with examples as follow. Some were residual ("other") categories that tended to be relatively low cost, such as 'Other Infectious Diseases' and 'Other Endocrine, Metabolic, Nutritional Disorders'. Some, more specific categories with little empirical or clinical implications for future costs such as 'Benign Neoplasm' and 'Abdominal Hernia, Uncomplicated' were also excluded. 'Appendicitis' was excluded. Although it is a non-discretionary admission, it has little impact on future cost. However, some diagnoses that are associated with higher future costs were also excluded. For example, 'Diabetes with No or Unspecified Complications' was excluded because it is not clear why uncomplicated diabetes requires inpatient hospital care. 'Protein-Calorie Malnutrition' was excluded because it is identified by vague or ambiguous diagnoses. PIPDxGs indicated by symptoms rather than diagnoses—such as 'Fever' or 'General

Symptoms' were also excluded. The PIPDxGs 'Poisoning/Toxic Effects' and 'Complications of Medical Procedures and Care' were excluded because they can represent poor quality of care and may be erratically coded. Most V-code diagnoses were excluded because they are not diagnoses, but rather procedures such as "screening/observation" or other miscellaneous circumstances.[4]

Special attention was given to the problematic case of 'Chemotherapy'. The Chemotherapy PIPDxG is defined using two ICD-9-CM V-codes ("V581 - chemotherapy encounter" and "V672 - chemotherapy follow up"); these codes do not distinguish the location or severity of the cancer, the type of drug regimen used, or frequency of treatment. Under current HCFA diagnostic coding guidelines, hospitals must code the V-code for chemotherapy in the space for the "principal" diagnosis, rather than a diagnosis code indicating the location or severity of the neoplasm, for patients admitted for chemotherapy. Chemotherapy is one of the highest cost PIPDxGs; if chemotherapy is included in the model at its empirically determined rate, then any person admitted for chemotherapy will be placed in the highest PIPDCG. If it is excluded from the payment model, then no additional payment will be generated for patients hospitalized for this reason.

Good arguments can be made for either excluding or fully including chemotherapy in the PIPDCG payment model. The primary argument for excluding chemotherapy is that it is procedure-based, rather than diagnosis-based. For a subset of chemotherapy patients,

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[4] The V-code 'Artificial Opening of Gastrointestinal Tract Status' was included, but the V-code 'Tracheostomy/Respirator Dependence' excluded because the former is a relatively common principal inpatient diagnosis and has a high admission rate whereas the latter is very rare as a principal inpatient diagnosis (only 8 cases in our sample) and has a low admission rate.

inpatient admission may be discretionary and paying more for inpatient chemotherapy tends to penalize plans which have been able to shift care to the outpatient setting. Concerns about rewarding care that may be inefficient are the main argument for excluding chemotherapy from a payment model.

There are also good arguments for including chemotherapy. The physicians on our panel believe that chemotherapy is no more "gameable" than several diseases that generate high payments such as congestive heart failure, or chronic obstructive pulmonary disease. Also there are clear incentives for providers not to admit patients undergoing chemotherapy because it exposes them to hospital based infections while their immune systems are compromised. Also, the precise HCFA DRG guidelines for coding chemotherapy may make it relatively easy to monitor the effect of the payment system on appropriate utilization. Finally, the PIPDCG model could be viewed as unfair if it does NOT pay HMOs more for patients who receive this extremely high cost procedure. In light of the conflicting arguments, we devoted special attention to how to pay for chemotherapy. Further discussion of this issue is provided in section 3.4.

After finalizing the definition and exclusion status of each PIPDxG, we changed the order of the PIPDxG list to be more logical and consistent[5]. Then we renumbered the PIPDxGs consecutively from 1 to 172. Thus, the PIPDxG numbers used in this report do not correspond to those in Ellis *et al.*, 1996. Table 3-1 shows descriptive statistics for the 172 PIPDxGs: number of people in 1995 with the principal diagnosis, mean 1996 Medicare

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[5] For example, Metastatic Cancer was moved to be the first rather than the last cancer category, in keeping with the general principle of listing more serious disease first.

expenditures for those people, the standard error of the mean, and the coefficient of variation of expenditures.[6,7] PIPDxGs excluded from the payment model have an '*' at the end of their label. A single person can be included in more than one PIPDxG in Table 3-1 if he or she was hospitalized more than once in 1995.[8]

For the full sample, mean 1996 payments are $5,186 and are $3,882 for beneficiaries with no 1995 hospital admissions. The PIPDxG means range from $53,692 for Tracheostomy Status/Respirator Dependence (with only 8 cases), and $30,818 for Chemotherapy to $1,927 for Normal Delivery (with only 32 cases) at the low end. The standard errors of mean expenditures are large for the high cost PIPDxGs, especially when they are based on few people. For example, Brain/Nervous System Cancer (PIPDxG 20) has a standard error of mean expenditures of $4,091, implying that the 'true' expenditure mean could range from roughly $19,000 to as high as $35,000.[9] Although more accurate estimates of the mean expenditures of some high cost PIPDxGs is desirable, clinical validity would be compromised if we combined heterogeneous diagnoses to obtain larger sample sizes.

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[6] Expenditures are annualized, and all statistics are weighted by fraction of the year (months) alive and eligible for our sample.

[7] A volume of appendix tables lists the specific diagnoses included in each PIPDCG, the ICD-9-CM codes included in each PIPDxG, and the PIPDxG and PIPDCG of each ICD-9-CM code.

[8] Women having an admission with a principal diagnosis indicating a completed pregnancy were excluded from the two PIPDxGs for uncompleted pregnancies. Two hospital admissions for the same or very similar, reasons will lead to inclusion in only one PIPDxG.

[9] This range is based on the mean plus or minus two standard errors.

3.4 Strategies for Paying for Chemotherapy

Accounting for the higher expected costs of Medicare beneficiaries who receive inpatient chemotherapy with the PIPDCG model presents a particular challenge in this project because of HCFA's inpatient diagnostic coding rules. These rules specify that all patients admitted for the primary reason of receiving chemotherapy are to be assigned a principal diagnosis of chemotherapy (either V581, chemotherapy encounter, or V672, chemotherapy follow up). Since the PIPDCG model is diagnosis-based, rather than procedure-based, project staff have wrestled with the appropriateness of its inclusion.

For some chemotherapy patients, inpatient admission may be discretionary, thus paying more for inpatient chemotherapy may encourage inappropriate admissions. Although such incentives may also exist for patients with other chronic diagnoses predictive of high future costs, such as congestive heart failure or chronic obstructive pulmonary disease, the projected high future cost of chemotherapy increases the importance of this issue. Cases with the primary diagnosis of chemotherapy are assigned to PIPDxG 162 with an average estimated annual cost of $30,818. This means chemotherapy, PIPDxG 162, would be placed in the highest PIPDCG.

Because of the costliness of these cases, several options for assigning persons with a PIPDxG 162 diagnosis to a PIPDCG were explored: (1) use principal inpatient diagnoses from other hospitalizations only; (2) use secondary diagnoses from the chemotherapy hospitalization; (3) use secondary diagnoses from all hospitalizations; and (4) use all diagnoses from all inpatient and outpatient claims. Figure 3-1 displays the implications of

using other diagnoses for classifying chemotherapy patients. The first column simply shows that 100% of all cases with a primary diagnosis of chemotherapy are assigned to PIPDxG 162 (1,034 cases), chemotherapy, using the primary inpatient diagnosis for PIPDxG assignment. The next four columns display what percentage of all cases assigned to PIPDxG 162, chemotherapy, would be assigned to any other payment increasing cancer PIPDxG using one of the four options discussed above. For example, using principal inpatient diagnoses from other hospitalizations only results in only 46.9% of chemotherapy cases being assigned to another cancer PIPDxG. Thus, payment rates for over half of these very costly cases would not be upwardly adjusted, if this method of assignment were adopted. In contrast, almost 93% of all chemotherapy PIPDxG cases would be assigned to other cancer PIPDxGs if the secondary diagnoses from the chemotherapy hospitalization were used for assignment. Using secondary diagnoses from all other inpatient hospitalizations or all diagnoses from all inpatient and outpatient encounters raises the percentage of chemotherapy PIPDxG cases assigned to other cancer PIPDxGs to nearly 100%. But, the increased administrative burden of using diagnoses from other claims would be considerably greater than using the secondary diagnoses from the chemotherapy hospitalization.

To what other PIPDxGs are the chemotherapy PIPDxG cases assigned? We examined the prevalence of secondary cancer diagnoses on the claim for the chemotherapy hospitalization only (Figure 3-2). Not surprisingly, over 35 percent of all secondary cancer diagnoses are assigned to the metastatic PIPDxG. This category includes secondary cancers of the lymph, respiratory, and digestive systems and other sites. Lung cancer as well as

cancers of the blood and lymphatic system are frequently and not unexpectedly occurring diagnoses among those receiving chemotherapy. It is important to note that all of the cancer PIPDxGs to which the chemotherapy PIPDxG cases are assigned are included in the PIPDCG payment model.

Lastly, we evaluated the average annual cost of cases assigned to the chemotherapy PIPDxG stratified by secondary diagnosis on the chemotherapy hospitalization. These data are displayed in Figure 3-3 and reveal considerable cost homogeneity across most categories of cancers. Cancers of the brain and nervous system are almost twice as costly as the average cancer case receiving chemotherapy, however, the number of cases is small.

These data suggest that excluding chemotherapy PIPDxG cases from the PIPDCG model will significantly underpay Managed Care Organizations (MCOs) for the cost of care for Medicare beneficiaries receiving chemotherapy. Access to high quality care for cancer patients within MCOs could be affected. These data also suggest inclusion of these cases in the preferred PIPDCG model will likely result in an increased adjustment for all cancer cases as the average cost of chemotherapy cases are higher than similar cancer cases not assigned to the chemotherapy PIPDxG.

Based on the physician panel and coauthors' recommendation, we used Option 2 by replacing chemotherapy PIPDxG with PIPDxGs from secondary inpatient cancer diagnoses in developing the PIPDCG sorting algorithm and payment models. One person is assigned only one secondary cancer diagnosis for that chemotherapy admission. If a person has more than one secondary cancer diagnosis, we assign the person to the single highest ranked cancer

PIPDxG based on the unsorted mean 1996 expenditure (Table 3-1). For example, a person who has both metastatic (PIPDxG 7) and breast (PIPDxG 14) cancer secondary diagnoses is assigned to PIPDxG 7 metastatic cancer.

There are 7.6% of people with chemotherapy admissions who do not have secondary cancer diagnoses from that admission. For model calibration, we assigned these admissions a principal diagnosis of PIPDxG 7, Metastatic Cancer. Metastatic cancer is the most common secondary cancer diagnosis among PIPs of chemotherapy, and it is consistent with the cost level of the chemotherapy admissions with no secondary cancer diagnosis. However, for payment purposes, we recommend that HCFA adopt a different strategy. Assigning all chemotherapy admissions without secondary cancer diagnoses to the highly-paid metastatic cancer category would give health plans an incentive not to code secondary cancer diagnoses for lower-paid types of cancer. Therefore, we recommend that for payment purposes, HCFA assign chemotherapy admissions without a cancer diagnosis to the lowest-paid cancer category, which is PIPDxG 14, Breast Cancer. This will give plans an incentive to provide the true cancer diagnosis for chemotherapy admissions.

3.5 Defining the Diagnostic Category for HIV/AIDS

A second very-high-cost diagnosis that we paid special attention to was HIV/AIDS. The 196 people with a 1995 principal inpatient diagnosis of HIV/AIDS had higher mean 1996 expenditures ($42,724) than any other diagnosis, with the exception of the 'Tracheostomy' PIPDXG 159, which had only 8 people.

The very high future costs of people with a principal diagnosis of HIV/AIDS created a dilemma as to whether AIDS should be placed in its own separate, very-high-cost payment category, despite small sample sizes. We decided to also examine the costs of people with a secondary inpatient diagnosis of AIDS to gain further information about costs. A hospital admission can be assigned to an HIV-related Diagnosis-Related-Group (DRG) with either a principal diagnosis of AIDS or a principal diagnosis of a significant HIV related condition and a secondary diagnosis of AIDS (3M, DRG Definitions Manual).

Table 3-2 shows the frequencies and mean expenditures of three mutually exclusive groups:

1. persons with a principal inpatient diagnosis of HIV/AIDS;
2. persons without a principal diagnosis of AIDS, but with a secondary diagnosis of AIDS; and
3. persons without a principal or secondary diagnosis of AIDS, but with a secondary diagnosis of HIV positive.

As can be seen from the table, persons with a principal diagnosis of AIDS are much more expensive than persons with a secondary diagnosis of AIDS or HIV positive. Table 3-3 shows the most frequent principal diagnoses for admissions with a secondary diagnosis of AIDS. Mental health diagnoses predominate; intravenous drug use is a major transmission mechanism for the HIV virus. Bacterial pneumonia and 'other infectious disease' (such as thrush or candidiasis) are common complications of AIDS.

There does not seem to be a clear rationale for when AIDS is coded as a principal versus a secondary diagnosis. According to Brown (1994, p. 97) 'Ordinarily, code 042

[AIDS] will be assigned as the principal diagnosis when the patient is admitted for treatment of the HIV infection and any related complications.' But discussions with our clinical panel indicated that the complications, not AIDS, are often coded as the principal diagnosis in practice. Paying a very large amount for people with a principal, but not secondary, diagnosis of AIDS would therefore encourage resequencing of diagnoses so that AIDS was the first-listed diagnosis.

To avoid establishing this incentive for resequencing, and to better capture the overall future expenditures for beneficiaries admitted with AIDS, we defined our HIV/AIDS diagnostic category (PIPDXG 3) as anyone with either a principal or secondary inpatient HIV/AIDS diagnosis in 1995. This modification was made only for the payment version of our model, not the profiling version. The diagnosis 'HIV positive' was not included in our HIV/AIDS diagnostic category.

Table 3-1

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
--	Entire Sample	1,387,105	$5,186	$12	274
-1	Invalid PIP*	6	23,270	12,560	124
0	No Inpatient Admission	1,128,738	3,882	11	294
1	Central Nervous System Infections	222	11,291	1,371	178
2	Septicemia (Blood Poisoning)/Shock	5,294	18,164	439	164
3	HIV/AIDS (Total)[1]	435	30,614	2,606	163
3a	HIV/AIDS (Principal)[2]	196	42,724	4,939	142
3b	HIV/AIDS (Secondary)[3]	239	22,036	2,598	173
4	Tuberculosis	116	14,726	2,782	195
5	Other Infectious Disease*	2,899	13,223	456	179
6	Late Effects*	104	14,891	2,530	167
7	Metastatic Cancer (Total)[4]	1,960	26,407	982	135
7a	Metastatic Cancer (Principal)[5]	1,574	25,229	1,115	143
7b	Metastatic Cancer (Secondary)[6]	386	30,982	2,042	108
8	Mouth/Pharynx/Larynx/Other Respiratory Cancer (Total)[4]	392	17,740	1,854	192
8a	Mouth/Pharynx/Larynx/Other Respiratory Cancer (Principal)[5]	370	16,764	1,762	188
8b	Mouth/Pharynx/Larynx/Other Respiratory Cancer (Secondary)[6]	22	35,650	14,891	175
9	Liver/Pancreas/Esophagus Cancer (Total)[4]	363	25,692	2,768	160

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
9a	Liver/Pancreas/Esophagus Cancer (Principal)[5]	336	25,014	2,933	167
9b	Liver/Pancreas/Esophagus Cancer (Secondary)[6]	27	33,496	7,457	93
10	Stomach, Small Bowel, Other Digestive Cancer (Total)[4]	433	15,253	1,497	176
10a	Stomach, Small Bowel, Other Digestive Cancer (Principal)[5]	423	14,985	1,505	179
10b	Stomach, Small Bowel, Other Digestive Cancer (Secondary)[6]	10	30,981	11,836	89
11	Colon Cancer (Total)[4]	2,217	11,287	463	184
11a	Colon Cancer (Principal)[5]	2,207	11,182	453	181
11b	Colon Cancer (Secondary)[6]	10	38,780	25,594	183
12	Rectal Cancer (Total)[4]	829	14,939	928	168
12a	Rectal Cancer (Principal)[5]	811	14,821	935	169
12b	Rectal Cancer (Secondary)[6]	18	20,276	6,942	136
13	Lung Cancer (Total)[4]	1,622	18,603	924	171
13a	Lung Cancer (Principal)[5]	1,521	18,214	925	170
13b	Lung Cancer (Secondary)[6]	101	24,840	5,205	175
14	Breast Cancer (Total)[4]	2,242	7,018	298	197
14a	Breast Cancer (Principal)[5]	2,231	6,941	296	198
14b	Breast Cancer (Secondary)[6]	11	26,964	8,175	88

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
15	Blood, Lymphatic Cancers/Neoplasms (Total)[4]	1,048	29,894	1,898	179
15a	Blood, Lymphatic Cancers/Neoplasms (Principal)[5]	921	29,540	2,090	187
15b	Blood, Lymphatic Cancers/Neoplasms (Secondary)[6]	127	32,465	3,921	118
16	Cancer of Uterus/Cervix/Female Genital Organs (Total)[4]	824	9,534	663	194
16a	Cancer of Uterus/Cervix/Female Genital Organs (Principal)[5]	813	9,441	656	193
16b	Cancer of Uterus/Cervix/Female Genital Organs (Secondary)[6]	11	17,519	11,732	200
17	Cancer of Placenta/Ovary/Uterine Adnexa (Total)[4]	333	22,031	1,822	139
17a	Cancer of Placenta/Ovary/Uterine Adnexa (Principal)[5]	281	20,847	1,994	148
17b	Cancer of Placenta/Ovary/Uterine Adnexa (Secondary)[6]	52	28,823	4,295	96
18	Cancer of Prostate/Testis/Male Genital Organs (Total)[4]	2,174	7,544	319	191
18a	Cancer of Prostate/Testis/Male Genital Organs (Principal)[5]	2,171	7,542	319	191
18b	Cancer of Prostate/Testis/Male Genital Organs (Secondary)[6]	3	9,099	5,113	96
19	Cancer of Bladder, Kidney, Urinary Organs (Total)[4]	1,480	13,154	684	189
19a	Cancer of Bladder, Kidney, Urinary Organs (Principal)[5]	1,460	13,045	688	191
19b	Cancer of Bladder, Kidney, Urinary Organs (Secondary)[6]	20	21,954	6,121	112
20	Brain/Nervous System Cancer (Total)[4]	124	27,127	4,091	126
20a	Brain/Nervous System Cancer (Principal)[5]	123	27,131	4,150	127

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
20b	Brain/Nervous System Cancer (Secondary)[6]	1	26,832	0	0
21	Other Cancers (Total)[4]	404	14,023	1,473	197
21a	Other Cancers (Principal)[5]	383	13,414	1,473	201
21b	Other Cancers (Secondary)[6]	21	27,068	9,125	133
22	Benign Brain/Nervous System Neoplasm	294	14,001	1,497	179
23	Benign Neoplasm, Except Brain/Nervous System*	1,946	8,093	390	210
24	Carcinoma in Situ/Neoplasm of Uncertain Behavior/Skin Cancer*	898	10,413	923	255
25	Diabetes with No or Unspecified Complications*	1,514	15,495	689	168
26	Diabetes with Acute Complications/Hypoglycemic Coma	703	16,579	1,200	182
27	Diabetes with Chronic Complications	2,672	23,093	658	141
28	Disorders of Fluid/Electrolyte/Acid-Base Balance*	7,230	16,550	349	168
29	Adrenal Gland, Metabolic Disorders	271	18,914	2,927	238
30	Protein-Calorie Malnutrition*	267	24,124	2,284	135
31	Other Endocrine, Metabolic, Nutritional Disorders*	930	10,582	744	208
32	Pancreatitis/Other Pancreatic Disorders	1,991	12,599	549	190
33	End Stage Liver Disorders	246	24,154	4,124	242
34	Cirrhosis, Other Liver Disorders	722	20,273	1,595	194
35	Diseases of Esophagus*	2,644	11,825	535	226
36	Peptic Ulcer	3,880	10,903	347	192
37	Stomach Disorders*	4,265	13,863	366	165

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
38	Appendicitis*	552	6,185	622	235
39	Abdominal Hernia, Complicated	852	9,423	626	190
40	Abdominal Hernia, Uncomplicated*	2,276	9,003	420	218
41	Inflammatory Bowel Disease	452	13,871	1,215	183
42	Gastrointestinal Obstruction/Perforation	5,893	13,612	343	186
43	Diverticula of Intestine*	4,641	10,640	285	178
44	Gallbladder Disorders*	6,249	7,873	233	230
45	Gastrointestinal Hemorrhage	2,602	14,884	589	191
46	Anal/Rectal/Other Intestinal Disorders*	3,109	12,394	428	187
47	Gout/Arthropathy/Derangements*	1,059	12,336	692	179
48	Connective Tissue Disease/Sarcoidosis	1,064	14,049	710	161
49	Bone/Joint Infections/Necrosis	1,218	16,031	778	164
50	Osteoarthritis*	9,661	6,793	138	198
51	Back Disorders*	5,428	9,552	246	187
52	Disorders of Soft Tissue*	1,314	11,004	569	184
53	Other Bone Disorders*	2,883	14,010	432	159
54	Iron Deficiency Anemia and Other/Unspecified Blood Disease*	1,488	17,671	911	186
55	Blood/Immune Disorders	1,159	21,482	1,172	171
56	Dementia	3,236	14,133	473	179
57	Drug/Alcohol Psychoses	939	14,820	802	162
58	Delirium/Hallucinations	776	15,438	832	144

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
59	Schizophrenic Disorders	3,982	12,771	319	157
60	Major Depression/Manic and Depressive Disorders	6,134	15,009	290	149
61	Paranoia and Other Psychoses	1,088	15,309	765	160
62	Non-Psychotic Depression*	750	14,285	800	150
63	Anxiety Disorders	317	15,072	1,189	139
64	Alcohol/Drug Dependence	1,905	12,216	495	175
65	Nondependent Alcohol/Drug Abuse*	237	14,248	1,618	172
66	Personality Disorders	162	17,090	1,685	124
67	Mental Retardation*	27	7,378	2,624	184
68	Other Mental Disorders/Substance Misuse*	1,111	12,729	605	155
69	Headache	295	11,879	1,099	157
70	Degenerative Neurologic Disorders	681	16,730	928	138
71	Essential Tremor and Other Abnormal Movement Disorders*	112	12,327	1,688	139
72	Paralytic and Other Neurologic Disorders	835	18,829	914	136
73	Epilepsy and Other Seizure Disorders	2,259	15,816	578	167
74	Mononeuropathy*	374	10,485	934	170
75	Polyneuropathy	268	21,237	2,228	165
76	Coma and Encephalopathy	208	21,355	2,151	137
77	Valvular and Rheumatic Heart Disease	1,696	11,310	556	197
78	Hypertension, Uncomplicated*	858	10,499	584	160
79	Hypertension, Complicated	598	12,157	935	185

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
80	Coronary Atherosclerosis	17,241	11,052	167	195
81	Post-Myocardial Infarction	517	12,785	1,004	171
82	Acute Myocardial Infarction	9,916	11,587	245	203
83	Unstable Angina	5,782	12,625	315	186
84	Angina Pectoris	1,887	11,675	452	165
85	Heart Rhythm and Conduction Disorders*	5,363	11,448	298	185
86	Atrial Arrhythmia	6,927	11,124	283	206
87	Paroxysmal Ventricular Tachycardia	922	13,931	978	204
88	Cardio-Respiratory Failure and Shock	2,512	23,700	812	158
89	Congestive Heart Failure	18,378	18,660	238	161
90	Other Heart Diagnoses*	156	11,672	1,448	151
91	Cerebral Hemorrhage	1,213	14,525	905	207
92	Precerebral Arterial Occlusion	5,096	10,415	297	199
93	Stroke	10,470	14,560	246	165
94	Transient Cerebral Ischemia	4,813	12,226	332	183
95	Atherosclerosis of Major Vessel	2,530	18,973	625	159
96	Aortic and Other Arterial Aneurysm	1,739	9,785	593	247
97	Thromboembolic Vascular Disease	5,286	13,720	350	179
98	Peripheral Vascular Disease	1,348	16,198	746	162
99	Thrombophlebitis*	387	14,834	1,522	196
100	Hypotension*	1,130	16,516	830	162

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
101	Other Circulatory Disease*	895	14,190	766	157
102	Eye Disorders*	1,065	10,008	694	222
103	Ear Disorders*	921	7,753	480	186
104	Nose, Throat, and Mouth Disorders*	941	11,397	783	205
105	Chronic Obstructive Pulmonary Disease	10,732	18,904	314	163
106	Bronchitis, Except Chronic*	2,104	13,567	572	186
107	Viral Pneumonia/Influenza/Pleurisy*	553	10,902	1,055	221
108	Gram-Negative/Staphylococcus Pneumonia	3,816	19,618	535	156
109	Bacterial Pneumonia	15,266	14,961	234	183
110	Asthma	1,341	13,300	750	203
111	Pulmonary Fibrosis and Bronchiectasis	451	18,935	1,742	182
112	Aspiration Pneumonia	1,869	22,630	936	159
113	Pleural Effusion/Pneumothorax/Empyema	1,044	16,145	1,185	217
114	Other Lung Disorders*	659	17,654	1,207	166
115	Renal Failure/Nephritis	1,464	22,725	978	151
116	Kidney Infection	1,090	12,812	665	167
117	Renal/Ureteral/Bladder Calculus*	1,425	7,122	442	232
118	Urethral Stricture/Hydronephrosis/Other Renal, Urethral Disorders*	549	13,168	1,235	209
119	Urinary Tract Infection*	5,915	17,357	363	151
120	Other Urinary System Disorders*	916	12,191	826	196
121	Hyperplasia of Prostate*	3,747	7,397	279	227

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
122	Other Disorders of the Male Genital Organs*	540	9,807	912	212
123	Menopausal and Post-Menopausal Disorders*	132	10,057	2,762	311
124	Disorders of the Female Genital Organs*	1,415	6,492	394	227
125	Genital Prolapse*	2,555	4,165	220	266
126	Ectopic Pregnancy	14	3,833	863	84
127	Miscarriage/Terminated Pregnancy	16	6,389	2,429	152
128	Completed Pregnancy with Major Complications	27	10,673	5,701	276
129	Completed Pregnancy with Complications	87	2,945	1,199	380
130	Completed Pregnancy without Complications (Normal Delivery)	32	1,927	470	138
131	Ongoing Pregnancy with Complications[†]	116	4,851	1,119	248
132	Ongoing Pregnancy with No or Minor Complicatons[†]	86	4,815	1,868	360
133	Cellulitis and Bullous Skin Disorders	4,428	14,728	373	163
134	Decubitus and Chronic Skin Ulcers	1,395	24,999	1,004	140
135	Other Dermatological Disorders*	367	13,898	1,336	178
136	General Symptoms*	1,926	14,660	609	175
137	Altered Consciousness/Amnesia/Fainting*	4,309	11,711	318	173
138	Fever*	703	14,895	1,008	172
139	Respiratory, Other Chest Symptoms*	675	13,496	994	184
140	Cardiovascular Symptoms*	7,398	10,443	227	184
141	Urinary System/Abdominal-Pelvis Symptoms*	1,946	12,289	550	192

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
142	Nervous/Musculoskeletal System Symptoms*	386	15,271	1,301	161
143	Vertebral Fracture Without Spinal Cord Injury	994	12,593	706	171
144	Spinal Cord Injury	71	19,879	3,830	158
145	Fractures of Skull/Face	254	11,789	2,088	273
146	Pelvic Fracture	1,067	10,983	634	181
147	Hip Fracture	9,759	11,411	221	183
148	Lower Limb Fracture*	1,896	7,830	345	189
149	Major Dislocations and Other Major Fractures*	1,286	9,625	542	196
150	Internal Injuries/Traumatic Amputations/Third Degree Burns	560	13,105	1,393	245
151	Open Wounds/Crushing Injury*	517	9,071	757	186
152	Sprains*	994	8,219	511	193
153	Brain Injury	569	11,122	927	191
154	Concussion, Other Intracranial Injury*	497	10,388	776	160
155	Poisoning/Toxic Effects*	1,754	14,333	562	160
156	Other Injuries*	2,338	11,263	448	186
157	Complications of Medical Procedures and Care*	8,443	14,439	304	188
158	Artificial Opening of Gastrointestinal Tract Status	673	13,177	1,078	205
159	Tracheostomy Status/Respirator Dependence*	8	53,692	19,625	93
160	Rehabilitation*	8,447	14,594	286	175
161	Radiation Therapy*	147	18,705	3,281	196
162	Chemotherapy**	1,034	30,818	1,463	130

Table 3-1 (continued)

Descriptive Statistics for PIPDxGs

PIPDxG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
163	Major Organ Transplant Status	-	-	-	-
164	History of Serious Illness/Devices*	215	12,108	1,970	230
165	Aftercare/Screening/Observation/Special Exams*	473	11,379	983	183
166	Extremely Low Birthweight Neonates	-	-	-	-
167	Very Low Birthweight Neonates	-	-	-	-
168	Serious Perinatal Problem Affecting Newborn	-	-	-	-
169	Other Perinatal Problems Affecting Newborn*	-	-	-	-
170	Normal, Single Birth*	-	-	-	-
171	Major Congenital Disorders*	182	11,649	2,379	269
172	Other Congenital Disorders*	67	8,560	1,774	169

*Excluded from the payment model.

**Chemotherapy was replaced with secondary cancer diagnoses in the model development, as discussed in Section 3.4.

†Persons with an admission in PIPDxGs 126-130 (completed pregnancies) are excluded from PIPDxGs 131 and 132 (uncompleted pregnancies).

[1] Including admissions with AIDS as principal or secondary inpatient diagnoses.

[2] Including admissions only with AIDS as principal inpatient diagnosis.

[3] Including admissions only with AIDS as secondary inpatient diagnosis.

[4] Including both principal inpatient diagnoses and secondary inpatient diagnoses for chemotherapy admissions.

[5] Principal inpatient diagnoses only.

[6] Secondary inpatient diagnoses for chemotherapy admissions only, excluding persons with a principal diagnosis of this cancer in 1995.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims.

OUTPUT: DIAG102.OUT, DIAG110C.OUT

Table 3-2

Frequencies and Mean Expenditures for HIV/AIDS and HIV/Positive Inpatient Diagnoses

	Number of 1995 People	Mean 1996 Expenditures[1]	Standard Error of the Mean	Coefficient of Variation (*100)
HIV/AIDS as Principal Inpatient Diagnosis	196	$42,724	$4,939	142
HIV/AIDS as Secondary Inpatient Diagnosis[2]	239	22,036	2,598	173
HIV Positive as Secondary Inpatient Diagnosis[3]	85	17,813	3,485	176

NOTES:

[1] Excluding IME and hospice expenditures; weighted by fraction of year alive.

[2] Excludes persons with AIDS as a principal inpatient diagnosis.

[3] Excludes persons with a principal or secondary inpatient AIDS diagnosis.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims.

OUTPUT: DIAG110B

Table 3-3

Top Five Principal Inpatient Diagnoses for Admissions with HIV/AIDS as a Secondary Diagnosis

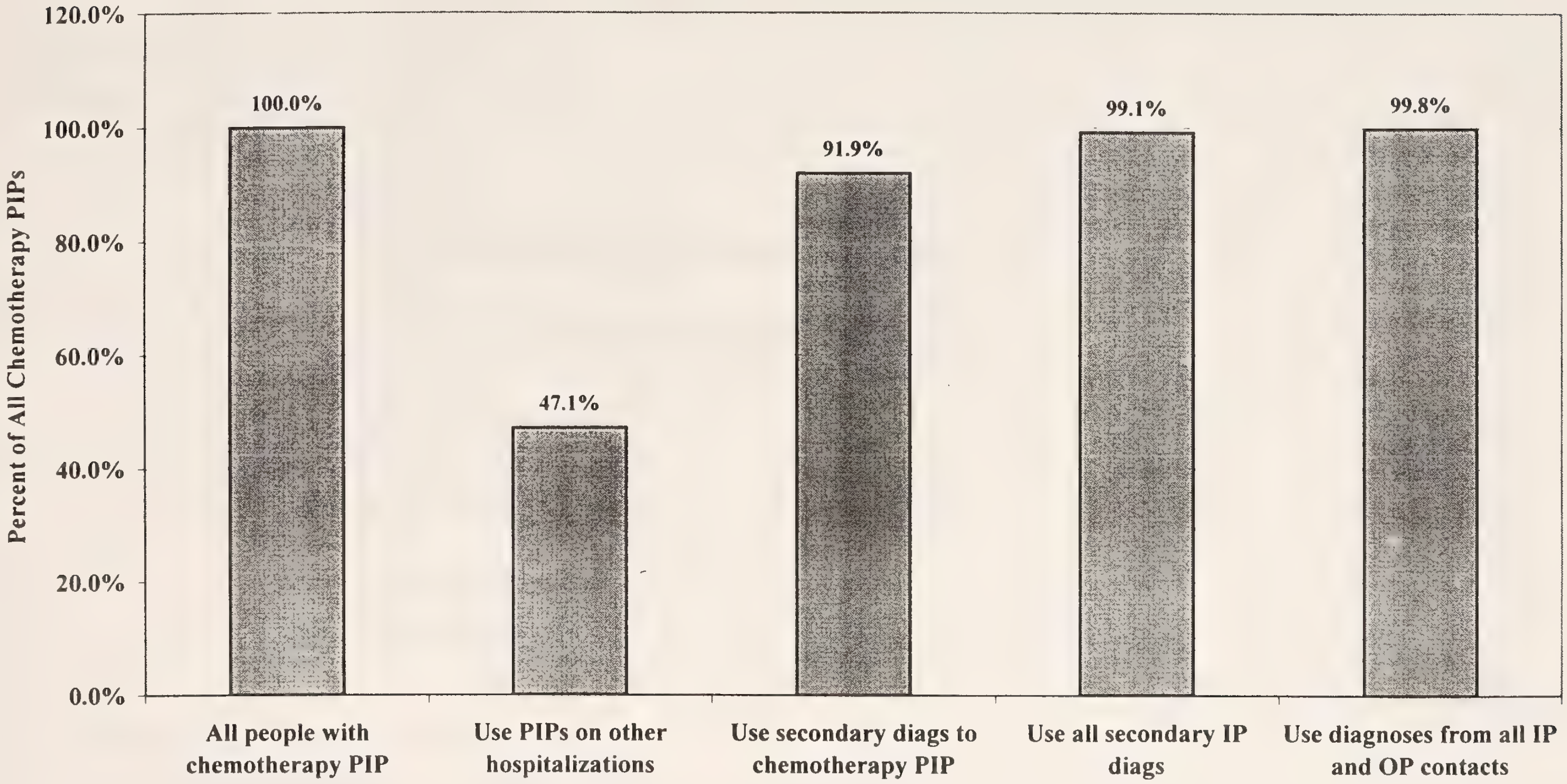
PIPDXG	Label	1995 Frequency	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
64	Alcohol/Drug Dependence	44	35,137	7,484	140
60	Major Depression/Manic and Depressive Disorders	37	36,235	4,751	77
109	Bacterial Pneumonia	29	20,428	7,129	176
5	Other Infectious Disease	27	22,863	7,737	156
59	Schizophrenic Disorders	19	32,498	6,739	84

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims.

OUTPUT: DIAG110B.OUT

Figure 3-1

Percent of Chemotherapy Patients Classified into a Payment Increasing Cancer PIPDxG by Alternative Assignment Rules



OUTPUT: DIAG99F.OUT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

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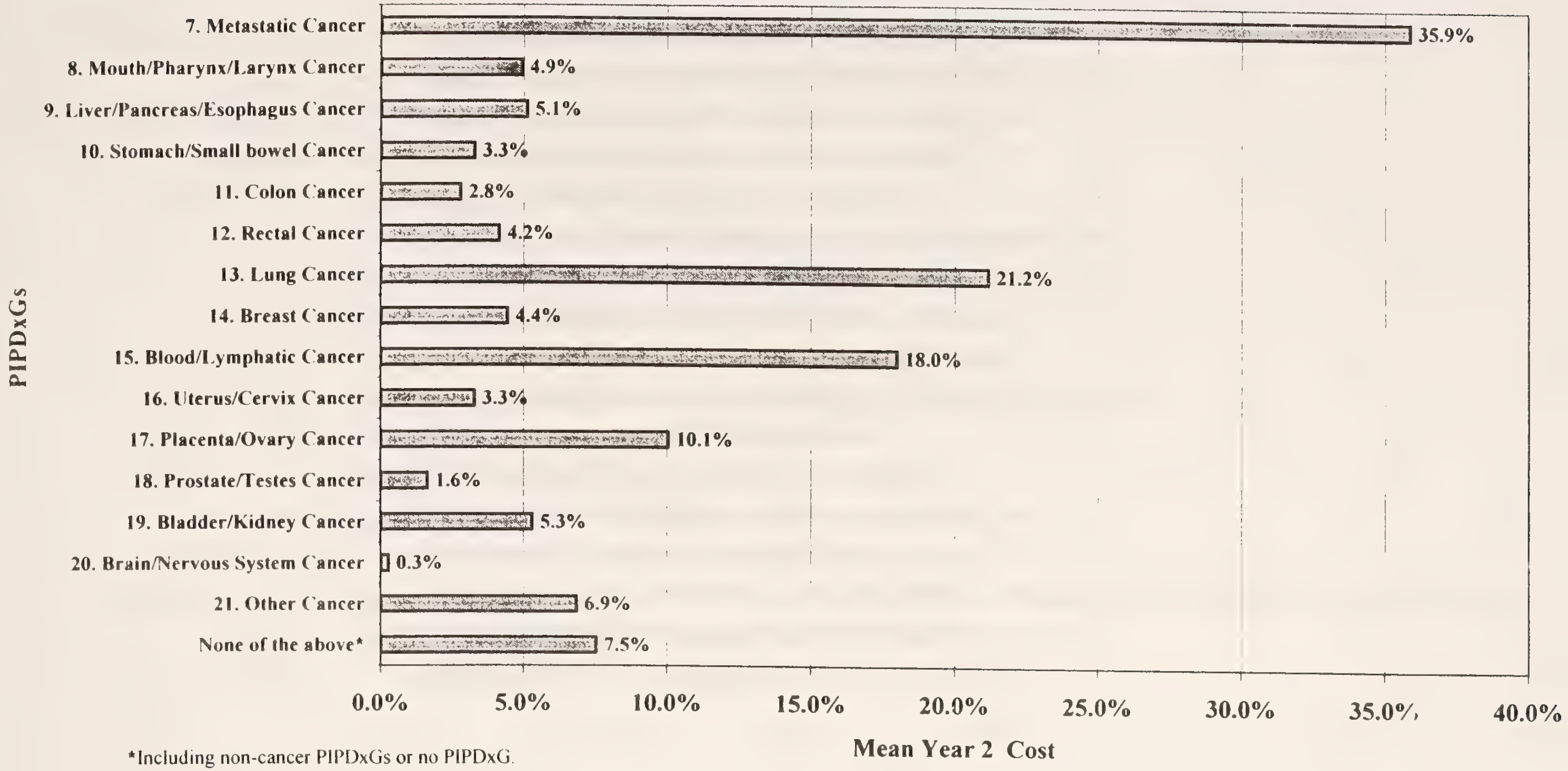
Figure 3-2

Prevalence of Cancer PIPDxGs from Secondary Diagnoses Among Those With Chemotherapy PIPs



*Including non-cancer PIPDxGs or no PIPDxG.

NOTE: Figure assumes the use of secondary diagnoses to chemotherapy PIP for classifying patients.

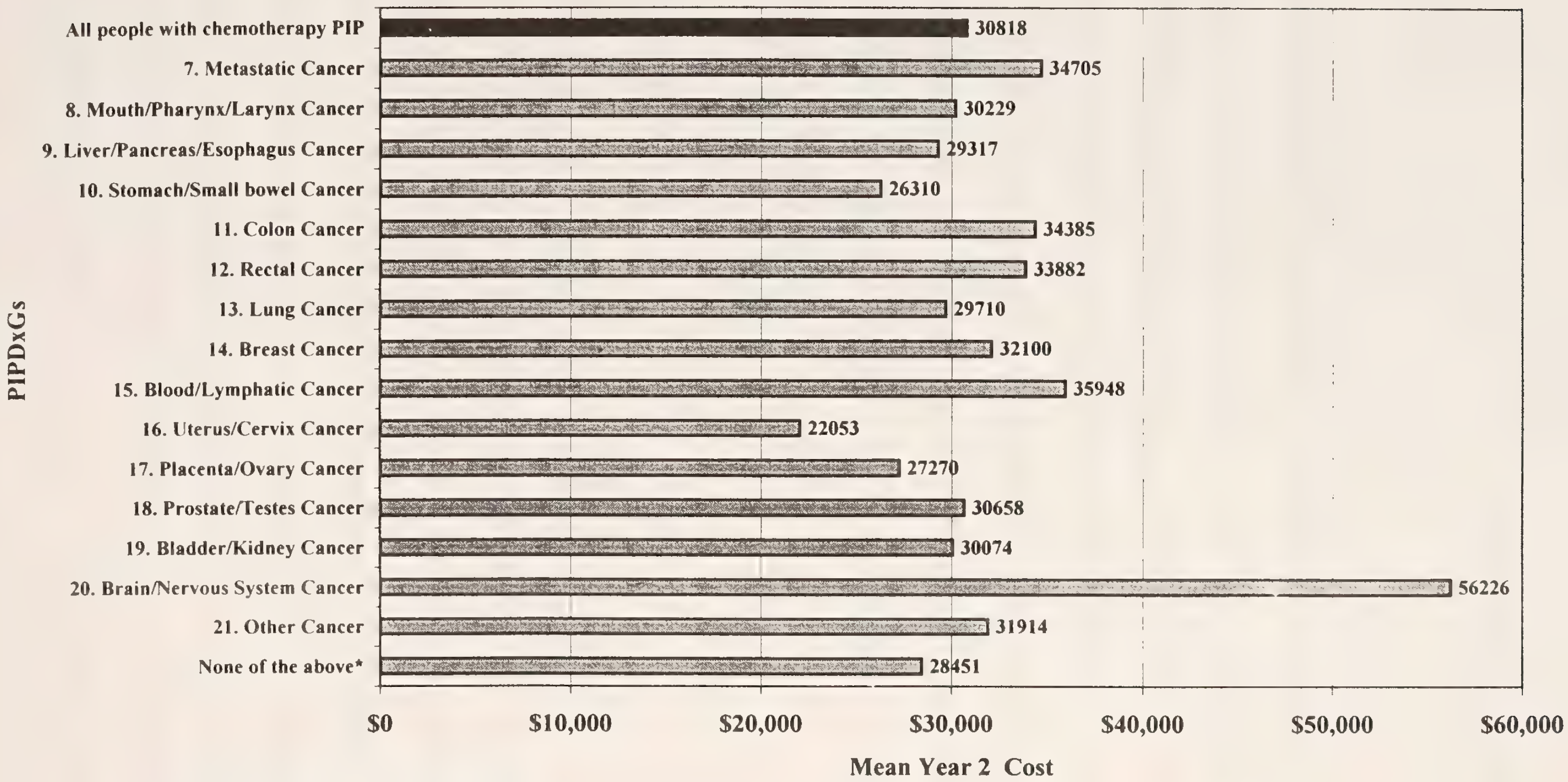
OUTPUT: DIAG99F.OUT

SOURCE: Health Economics Research, Inc analysis of 1995 and 1996 Medicare claims data.

dcg98\2draftrpt\chap3figs\Fig3-2\nd

Figure 3-3

Comparison of Mean Cost by Cancer PIPDxGs Secondary Diagnoses for Chemotherapy PIPs



*Including non-cancer PIPDxGs or no PIPDxG.

NOTE: Figure assumes the use of secondary diagnoses to chemotherapy PIP for classifying patients, regardless of other PIPs the person may have.

OUTPUT: DIAG99F.OUT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

4

PIPDCG and Age/Sex Models

This chapter presents Principal Inpatient Diagnostic Cost Group (PIPDCG) models developed using the classification system described in Chapter 3. We first discuss a baseline age/sex model (Section 4.1). Section 4.2 develops and estimates of two PIPDCG models: a payment model with the exclusions of diagnoses specified in Chapter 3, and a full model without any diagnostic exclusions. Section 4.3 presents descriptive statistics for the two sets of Principal Inpatient Diagnostic Cost Groups (PIPDCGs). All models discussed in this chapter are limited to age, sex, and diagnosis. Additional demographic risk adjustment factors are analyzed in the next chapter.

4.1 Age/Sex Model

We first fit a basic age/sex model that is used as a benchmark for other models. It captures Medicare expenditure patterns by age/sex groups (Table 4-1). Medicare payments in 1996 are regressed on 24 age/sex cells, with no intercept term. As in all regressions and statistics presented in this report, expenditures are annualized and the regression is weighted by the fraction of the year each person is alive and eligible for our sample (see Ellis *et al.*, 1996 for more discussion of annualization and weighting). Two changes are made to the age/sex model from previous work (Pope *et al.*, 1999). First, the age 55-64 group is split into age 55-59 and age 60-64 for both men and women. This age split is currently used in

Medicare's AAPCC-based payment methodology, and expenditures are significantly higher for the older group.

The second change is that people are assigned to more than one age cell if they aged into a new cell during 1996. Previously, a person was assigned to one age cell for the entire year based on January 1 age. See Section 2.3.1 for further description of these 'fractional' age variables.

Table 4-1 contains two models. Model 1 has the age 55-64 split into 55-59 and 60-64 cells, but assigns age based on January 1, 1996. Model 2 prorates age across cells using fractional age variables where appropriate. Differences between the two models are slight, but prorating age does result in a slightly better fit to the data (higher R-square). Model 2 is more technically correct, but the results suggest that January 1 age (or presumably age any time during the year) can be used as a close proxy. In some datafiles (e.g., health plan files), only age in years, or year of birth may be available, rather than exact date of birth. In the remainder of this report, we use the prorated age cells in all analyses.

The age coefficients increase monotonically for both men and women from age 0-34 through 60-64, then again from age 65-69 through 90-94. Women age 95 or over are slightly less expensive than age 90-94, although expenditures for men (Model 2) continue to rise through the oldest age group. Mean expenditures do fall substantially in the disabled/elderly transition, markedly so for women. Thus, a health plan would receive a cut in payment for an under-age-65 Medicare beneficiary aging into elderly entitlement status under a pure age/sex model. This is one motivation for including the 'ever disabled' variable discussed

in Chapter 5. Age/sex coefficients, representing mean payments, range from $3,392 for age 0-34 men to $9,110 for men age 95 or older. Under-age-65 disabled women are more expensive on average than men of the same age. But among the elderly, women are less expensive than men in every age range.

4.2 PIPDCG Models

Next we add diagnoses to the age/sex model defined in the previous section. This is done in two steps. First, the PIPDCG sorting algorithm is used to sort diagnoses (PIPDxGs) by their expected costliness in the next year, and to make a preliminary assignment of people to a unique Principal Inpatient Diagnostic Cost Group, or PIPDCG. Second, the preliminary PIPDCG assignment of diagnoses is adjusted based on statistical and clinical criteria. Third, the final PIPDCG regression model is estimated. The PIPDCG sorting algorithm process and results are described in Section 4.2.1, adjustments to the preliminary PIPDCG assignment from the sorting algorithm are described in Section 4.2.2, and regression estimates of the final model are discussed in Section 4.2.3.

Of our two PIPDCG models, we favor the one with exclusions for payment purposes, and refer to it as "the payment model". The model without exclusions is useful as a baseline for comparison to the payment model, and possibly for profiling or other non-payment uses. Exclusion of diagnoses is discussed in Chapter 3.

4.2.1 DCG Sorting Algorithm

For this project, we used a slight modification of the sorting algorithm described in Ellis *et al.*, 1996. We begin by ranking diagnoses, PIPDxGs (see Chapter 3), by the mean 1996 expenditure of all people with the diagnosis in 1995, and grouping the highest expenditure PIPDxGs into the highest-numbered Principal Inpatient Diagnostic Cost Group, or PIPDCG. Each person admitted to the hospital in 1995 with a principal inpatient diagnosis included in one of those categories is then uniquely assigned to this highest-numbered PIPDCG. These highest-cost people are then removed from the sample, and the remaining PIPDxGs are reranked by their recalculated mean expenditures (based only on the people who remain in the sample). The highest-cost remaining PIPDxGS are then grouped into the next highest-numbered PIPDCG, and people with those diagnoses are assigned to that PIPDCG and removed from the sample. This process is repeated until all people have been assigned to a unique PIPDCG. People with no hospital admissions in 1995 are also included in the sorting algorithm, in their own group, PIPDxG 0. The sorting algorithm is constrained so that no diagnosis (PIPDxG) is assigned to a lower PIPDCG than the PIPDCG containing people with no hospital admissions (PIPDxG 0). This ensures that a health plan is never penalized for recording a diagnosis.

The purpose of the sorting algorithm is to identify the single principal hospital diagnosis most predictive of future cost, given that individuals may have multiple hospitalizations, and thus multiple diagnoses. Often the single highest-cost diagnosis is also the fundamental underlying clinical driver of costs. PIPDCGs group heterogeneous

diagnoses so long as they have similar future cost implications. Unlike, say, DRGs, PIPDCGs have no inherent clinical meaning, and are not given a clinical label. Rather, PIPDCGs are defined by reference to ranges of expenditures, and each PIPDCG is identified by a number that refers to the lower bound of its expenditure range. In the DCG sorting algorithm runs, a preliminary set of PIPDCGs was defined using $500 expenditure ranges, e.g., $15,000 to $15,499 and $15,500 to $15,999. These very narrow ranges were used to maximize the power of the sorting algorithm to discriminate among the costliness of diagnoses. Later, as described in the next section, the preliminary set of PIPDCGs was aggregated into more statistically stable final PIPDCGs using broader expenditure ranges.

If at any time during the sorting algorithm, a PIPDxG had fewer than 50 individuals remaining in it, that PIPDxG was assigned to the lowest-numbered PIPDCG (the one containing people with no hospital admissions) and removed from the sorting algorithm. This was done because mean expenditures computed with less than 50 observations were not considered reliable.[1] The PIPDxGs assigned to the lowest-numbered PIPDCG were later reviewed, and their assignment was evaluated based on clinical judgment. If clinically appropriate, they were reassigned.

Two sorting algorithms were run. The first included all 172 diagnosis PIPDxGs, plus PIPDxG 0 for people with no 1995 inpatient admissions. This is referred to as the "full" or "complete" sorting algorithm. It is used to develop the PIPDCG model without exclusions of diagnoses. The second sorting algorithm excluded 75 of the 172 PIPDxG diagnostic

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[1] A relatively low sample size threshold was used to maximize classification by empirical information, rather than clinical judgement, for rare but expensive diagnoses.

groups as discussed in Chapter 3. Excluded admissions were assigned to PIPDxG 0, that is, they were ignored. This second sorting algorithm was used to develop the PIPDCG model with exclusions, or the payment model. The results of these two sorting algorithms are shown in Tables 4-2 and 4-3, respectively.

In the full sorting algorithm (Table 4-2), the highest preliminary PIPDCG is formed at expenditure level 42.5 (i.e., $42,500), and includes only HIV/AIDS. The next preliminary PIPDCG is created at level 30.5 (i.e., $30,500), and includes only Chemotherapy. There are few 'gaps' in the $500 expenditure ranges once level 25.5 ($25,500) is reached. At the bottom end, preliminary PIPDCG 3.5 includes people without a 1995 hospital admission, whose mean expenditure is $3,882. The sample size of several PIPDxGs—for example, PIPDxG 90 'Other Heart Diagnoses'--falls below 50 in the course of the sorting algorithm, and they are assigned to PIPDCG 3.5 pending clinical review.

Several diagnoses that are excluded from the payment model receive relatively high preliminary PIPDCG assignments in the full sorting algorithm. These include Urinary Tract Infection (PIPDCG 15.0), Disorder of Fluid/Electrolyte/Acid-Base Balance (PIPDCG 13.5), Nervous/Musculoskeletal System Symptoms (PIPDCG 12.0), and Fever (PIPDCG 10.0). These diagnoses are not necessarily or usually chronic or clinically significant in terms of future cost implications in themselves, but apparently serve as markers for individuals who are debilitated or in poor health.

Table 4-3 shows the results of the sorting algorithm with our diagnostic exclusions. Note that *individuals* with admissions for excluded diagnoses may still be sorted into high-

numbered PIPDCGs in this sorting algorithm. This occurs when they are admitted to the hospital more than once in 1995, with at least one admission for a high-cost diagnosis that is included in the payment model. We examine the extent to which diagnoses from multiple hospitalizations pick up the costs of individuals admitted for excluded diagnoses later in this report.

In the sorting algorithm with exclusions, the highest preliminary PIPDCG is formed at expenditure level 30.5, and includes only HIV/AIDS. The expenditure level for HIV/AIDS is much lower than in the sorting algorithm without exclusions because secondary as well as principal inpatient diagnoses are used to identify AIDS admissions. Chemotherapy does not appear in this sorting algorithm because chemotherapy admissions are classified by their secondary cancer diagnoses. The mean costs of many of the cancer diagnoses therefore are greater than in the full model, and they are assigned to higher PIPDCGs, because the 1,054 people admitted for chemotherapy are no longer pulled out into a higher PIPDCG. Blood, Lymphatic Cancer/Neoplasms, Brain/Nervous System Cancer, and Metastatic Cancer form the next three preliminary PIPDCGs below HIV/AIDS. PIPDCGs are formed at almost all $500 expenditure increments through PIPDCG 4.0, which includes people with no or excluded admissions, whose mean cost is $4,135 (after sorting). The PIPDCG assignments of diagnoses still included in the model rise because of the exclusion of some diagnoses.

4.2.2 Final PIPDCG Assignment

The use of $500 increments results in a large number of preliminary PIPDCGs, some with small sample sizes. Experimentation showed that the preliminary PIPDCGs could be collapsed into a smaller number of final PIPDCGs with virtually no sacrifice of explanatory power (R-square). The smaller, more manageable number of final PIPDCGs are based on broader expenditure ranges with larger sample sizes, and are more stable statistically. Using the principles set forth in Ellis *et al* (1996), we developed the following expenditure ranges for the final PIPDCGs:

Final PIPDCG	DxGroup Average Cost (Sorted)
4	$4,000 to 4,999
5	$5,000 to 5,999
6	$6,000 to 6,999
7	$7,000 to 7,999
8	$8,000 to 8,999
9	$9,000 to 9,999
10	$10,000 to 10,999
11	$11,000 to 11,999
12	$12,000 to 13,999
14	$14,000 to 15,999
16	$16,000 to 17,999
18	$18,000 to 19,999
20	$20,000 to 22,999
23	$23,000 to 25,999
26	$26,000 to 28,999
29	$29,000 to 31,999
32	$32,000 to 34,999
35	$35,000 to 39,999
40	$40,000 to 44,999

Expenditure increments in the higher expenditure range (above $9,000) were divided a little more finely than those used in Ellis *et al.*, 1996 (which used 1992 expenditures). This

reflects the higher average 1996 expenditure level, which results in larger sample sizes at higher expenditure ranges.

Preliminary sorting algorithm results were reviewed by the physician authors for clinical plausibility. Based on this review, we adjusted some PIPDCG assignments. This review occurred for only the PIPDCG model with exclusions, because of its potential use in payment, and because it is the model carried forward for further analysis.

'Personality Disorders' is the highest-ranked mental health category. It contains only 160 people (sorted), so its mean costs are not known precisely. Our clinical panel felt that 'Personality Disorders' should not be higher-ranked than any other mental health diagnosis, so we reassigned it from PIPDCG 16 to PIPDCG 14, which includes several other mental health diagnoses, such as 'Anxiety Disorders' and 'Paranoia and Other Psychoses'.

All the pregnancy-related diagnoses (PIPDxGs 126-132) were assigned to PIPDCG 4 by the sorting algorithm. These diagnoses are rare in the Medicare population, making it difficult to be certain of their true cost levels. If anything, pregnancy seems to be a marker of relatively good health, and is associated with lower costs next year than those of people without any base year hospital admissions. However, we felt that 'Ongoing Pregnancies' should be predictive of higher costs in the following year, when delivery presumably occurs. Thus, PIPDxG 131 'Ongoing Pregnancy with Complications' and PIPDxG 132 'Ongoing Pregnancy with No or Minor Complications' were reassigned from PIPDCG 4 to PIPDCG 5. All other pregnancy-related diagnoses were left in PIPDCG 4.

The physician authors reviewed the final PIPDCG assignments and found them to be clinically plausible. No other changes to the sorting algorithm assignments were made. The final assignment of diagnoses (PIPDxGs) to payment PIPDCGs is given in Table 4-4.

4.2.3 Parameterization of Final Models

PIPDCG Model with Exclusions. Regression estimates of the PIPDCG models with and without exclusions were made. In each case, annualized 1996 Medicare payments are regressed on the sets of PIPDCGs and age/sex cells. Estimates of the PIPDCG model with exclusions and age/sex demographic factors are shown in Table 4-5 as Model 2. The pure age/sex model is included as Model 1 for comparison. Adding principal hospital diagnoses to age/sex raises the model's explanatory power (R-square) from 0.9% to 5.8%. Model 2 of Table 4-5 is our base PIPDCG payment model. It is used for exploration of further risk adjustment issues (e.g., excluding short stays) and additional demographic risk adjusters later in this report.

Each person without a base year hospital admission, or with (an) admission(s) only for excluded diagnoses or completed pregnancy admissions, is assigned to PIPDCG 4, and is risk adjusted using only age/sex. People with admissions for included diagnoses are assigned to one of the other 14 PIPDCGs 5, 6, 7, 8, 9, 10, 11, 12, 14, 18, 20, 23, 26, or 29. For these people, risk adjustment includes diagnosis in addition to age/sex.

In Model 2 of Table 4-5, PIPDCG 4 is omitted, whereas all age/sex cells are included. Hence, the age/sex cell coefficients show the mean 1996 expenditures of people in

PIPDCG 4, that is, with no or only excluded hospital admissions, or a completed pregnancy admission. Alternatively, interpreting Model 2 as a payment model, the age/sex coefficients show the annualized payment for a person in PIPDCG 4 and in a particular age/sex cell. The coefficients for PIPDCGs 5 through 29 show the *marginal* expenditure/payment for a person with a 1995 principal inpatient diagnosis placing them in that PIPDCG.[2] For example, a 73 year old woman with a single 1995 admission for 'Precerebral Arterial Occlusion' is in PIPDCG 8, implying an annualized 1996 payment of $3,361 (age/sex coefficient) + $4,169 (PIPDCG 8 coefficient) = $7,530. The monthly payment would be $7,530/12 = $627.50. The woman's *relative risk score* is the predicted payment divided by the sample average (1996) mean expenditure of $5,186, or $7,530/$5,186 = 1.45. That is, the woman is predicted to be 45 percent more expensive than average in the prediction year (the year following diagnosis).

As can be seen by comparing the age/sex coefficients of Model 2 to Model 1 in Table 4-5, adding diagnosis lowers all age/sex payments, by $1,000 to $2,000. Thus, payments are reduced to health plans for healthier enrollees, with no or only excluded base year hospital admissions. But substantial differences in payment by age and sex remain after controlling for diagnosis, from $2,235 from 0 to 34 year old males to $7,391 for males age 95 or more. The payments "removed" from the age/sex cells are reassigned, of course, to the PIPDCG diagnostic categories. Incremental payments for included hospital principal diagnoses range from $1,696 for PIPDCG 5 to $26,232 for PIPDCG 29.

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[2] Recall that each person is uniquely assigned to a PIPDCG, either PIPDCG 4, or one of PIPDCGs 5 through 29.

PIPDCG Model Without Exclusions. We also estimated a the PIPDCG model without exclusions of diagnoses. This model is presented as Model 2 of Table 4-6, where the PIPDCG model with exclusions is included as Model 1 for comparison. All assignments of diagnoses (PIPDxGs) to PIPDCGs for this model were taken directly from the sorting algorithm shown in Table 4-2, without any clinical review. In the full sorting algorithm, people without a 1995 hospital admission were assigned to PIPDCG 3, not PIPDCG 4. They were assigned to a lower PIPDCG because they were not combined with people having excluded admissions, who are more expensive than people without admissions. We also assigned all diagnoses with no observations in our Medicare sample to DCG 3. Our Medicare data provides no basis on which to allocate these diagnoses to PIPDCGs, but assigning them to PIPDCG 3 maintains the exhaustive nature of the classification. PIPDCG 3 is omitted from the regression, thus the age/sex cells show predicted expenditures for people in PIPDCG 3.

The R-square for the PIPDCG model without exclusions is 6.4 percent, 0.6 percentage points or 9 percent larger than the 5.8 percent R-square for the PIPDCG model with exclusions. Excluding 44 percent of the diagnostic categories to improve payment incentives reduces the explanatory power of the PIPDCG model only moderately as measured by the R-square statistic. The age/sex coefficients of the model without exclusions are each one hundred or more dollars smaller than for the payment model, as more money is reallocated from age and sex to principal hospital diagnoses. The range of incremental costs of the PIPDCGs is greater in the model without exclusions, from $995 to $40,125,

compared to $1,696 to $26,232 in the payment model. The much greater highest payment in the 'without exclusions' model is due to the much higher costs of HIV/AIDS as a principal diagnosis as opposed to a secondary diagnosis.[3]

4.3 Descriptive Statistics for Principal Inpatient Diagnostic Cost Groups

Table 4-7 shows the number of admissions used in the various stages of developing the PIPDCG payment model. We began with 415,231 admissions in 1995. Almost 37 percent, or 153,276, of admissions are for diagnoses that are excluded from the model (see Chapter 3). However, about one-third of excluded admissions occur among people who have at least one other admission that is included in the payment model. Therefore, only about one-quarter of all admissions occur among people who have only excluded admissions. The remaining 261,955 non-excluded admissions participate in the PIPDCG sorting algorithm. More than 85,000, or one-third, of these admissions are not used in PIPDCG assignment because the person admitted has another, higher-ranked admission during 1995. (Recall that the PIPDCG model uses only a person's single highest-ranked admission during a year to assign his or her PIPDCG.) Only 42.5 percent of 1995 admissions are used to define the final PIPDCGs, including short stay admissions. If diagnoses from short stay admissions are then excluded (which is discussed later in this report), another 2.1 percent of admissions are not used in PIPDCG assignment.

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[3] The model with exclusions uses both principal and secondary diagnoses of HIV/AIDS, whereas the model without exclusions uses only principal diagnoses.

Table 4-8 presents descriptive statistics on the final payment PIPDCGs (PIPDCGs with exclusions). The number of sample people in the two highest-cost PIPDCGs, 29 and 26, are each quite small, only 1,475 and 2,067, respectively. Each category comprises 0.1 to 0.2 percent of the entire sample, and 0.5 to 1 percent of those hospitalized in the sample in 1995. PIPDCG 29 contains only HIV/AIDS and Blood Cancers (e.g., Leukemia), while PIPDCG 26 contains only Metastatic Cancer and Brain Cancer. The standard errors of their mean costs are relatively large. PIPDCGs 23, 20, and 18 are each somewhat larger, together comprising 1.16 percent of the sample and 6.2 percent of those hospitalized. PIPDCG 16 is the most frequent PIPDCG, accounting for 2.2 percent of the sample and 11.8 percent of those hospitalized. It contains the common Congestive Heart Failure and Chronic Obstructive Pulmonary Disease diagnoses. PIPDCG 14 contains the highest-ranked mental health diagnoses, while PIPDCG 12 contains Stroke, and is the third most common PIPDCG. PIPDCG 8 is the second most frequent PIPDCG, and contains several common heart-related diagnoses, such as Angina Pectoris and Coronary Atherosclerosis. The lowest-cost PIPDCGs 7, 6, and 5 have fewer cases than any but the highest-cost PIPDCGs 26 and 29. PIPDCG 6 contains only Prostate Cancer and PIPDCG 5 only Breast Cancer and Ongoing Pregnancies. PIPDCG 4 contains people with no 1995 hospital admission, excluded admissions only, and completed pregnancy diagnoses.

An incremental payment greater than zero (beyond the amount determined by a person's age and sex) is attached to PIPDCGs 5 through 29. People in PIPDCG 4 receive no incremental payment. Altogether, persons in PIPDCGs 5 through 29 comprise 12.8

percent of the sample, and 68.4 percent of sample persons hospitalized in 1995. In other words[4], the payment PIPDCG model uses principal hospital diagnoses to risk adjust payments for about 13 percent (one in eight) of Medicare beneficiaries; the other 87 percent are risk adjusted only by age, sex, and other demographics. Capitation payments are increased the following year for two-thirds of Medicare beneficiaries hospitalized in the base year; for one-third of beneficiaries hospitalized, payments remain the same.[5]

Table 4-8A presents the same information as Table 4-8, but for the PIPDCGs with short-stay (0- or 1- day stays) excluded. Exclusion of short-stay diagnoses will be analyzed more fully in Chapter 8 of this report. The distribution of beneficiaries across PIPDCGs is very similar with short stays excluded, although the number of beneficiaries in PIPDCGs 5-29 is slightly smaller, as expected.

Table 4-9 shows descriptive statistics for the PIPDCGs without exclusions. The residual PIPDCG 3 contains fewer people than PIPDCG 4 in the model with exclusions because no exclusions are made. In addition to people without 1995 admissions, PIPDCG 3 includes a few very low cost diagnoses. The numbers of people in the lower-cost PIPDCGs 5, 6, 7, and 8 are much higher in this model than when diagnoses are excluded from the model, indicating that many of the excluded diagnoses identify relatively lower-cost hospitalized beneficiaries. If this model were used for payment (not recommended), more than 18 percent of the sample (as opposed to 13 percent in the model with exclusions) would

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[4] Our data is from fee-for-service Medicare. The discussion in the remainder of this paragraph assumes that hospital admissions patterns are similar in managed care Medicare plans as a whole.

[5] Unless the beneficiary's demographic status changes, e.g., he or she ages into an older age cell.

be risk-adjusted by their hospital diagnoses, and next year's capitation payments would rise for almost all hospitalized beneficiaries, as compared to two-thirds in the model with exclusions.

Table 4-1

Two Age/Sex Models

Model:	1		2	
	January 1, 1996 Age		1996 Prorated Age Cells	
Number of Observations:	1,387,105		1,387,105	
R-Squared:	0.008897		0.008679	
Dependent Variable Mean:	5,186		5,186	
Root Mean Square Error:	13,944		13,946	
Model Parameters:	24		24	
Computer Output:	DIAG99G.OU2		DIAG99G.NEW	
Variable	**beta**	**t-ratio**	**beta**	**t-ratio**
AGE/SEX GROUPS:				
MALE: 0-34	3,497	27.87	3,398	25.71
MALE: 35-44	3,872	41.23	3,893	40.38
MALE: 45-54	4,128	46.81	4,081	45.42
MALE: 55-59	4,802	40.62	4,777	38.51
MALE: 60-64	5,487	52.16	5,496	50.00
MALE: 65-69	4,008	101.49	3,989	92.59
MALE: 70-74	4,877	131.34	4,762	124.57
MALE: 75-79	6,066	138.75	5,934	134.24
MALE: 80-84	7,169	128.32	7,041	125.91
MALE: 85-89	8,165	97.54	8,115	98.49
MALE: 90-94	9,041	60.22	8,813	60.68
MALE: 95+	8,993	28.73	8,862	30.32
FEMALE: 0-34	3,730	23.27	3,685	21.88
FEMALE: 35-44	4,192	34.69	4,211	33.91
FEMALE: 45-54	4,653	43.35	4,598	41.78
FEMALE: 55-59	5,569	40.99	5,464	38.48
FEMALE: 60-64	6,719	56.84	6,707	54.24
FEMALE: 65-69	3,492	99.12	3,481	89.87
FEMALE: 70-74	4,228	132.97	4,117	125.18
FEMALE: 75-79	5,241	148.95	5,141	143.35
FEMALE: 80-84	6,350	155.55	6,226	150.49
FEMALE: 85-89	7,315	138.10	7,241	136.57
FEMALE: 90-94	7,708	95.24	7,720	97.30
FEMALE: 95+	7,398	51.80	7,323	54.40

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 4-2

PIPDCG Sorting Algorithm, No Exclusions of PIPDxGs

Preliminary PIPDCG	PIPDXG	PIPDxG Label	Frequency	Mean
42.5	3	HIV/AIDS	196	42,724
30.5	162	Chemotherapy	1,033	30,859
28.0	15	Blood, Lymphatic Cancers/Neoplasms	832	28,375
25.5	20	Brain/Nervous System Cancer	119	25,940
24.5	134	Decubitus and Chronic Skin Ulcers	1,391	24,956
24.5	9	Liver/Pancreas/Esophagus Cancer	313	24,863
24.0	7	Metastatic Cancer	1,439	24,021
23.5	33	End Stage Liver Disorders	243	23,904
23.5	30	Protein-Calorie Malnutrition	256	23,834
23.5	88	Cardio-Respiratory Failure and Shock	2,493	23,602
22.5	27	Diabetes with Chronic Complications	2,563	22,727
21.5	112	Aspiration Pneumonia	1,789	21,994
21.0	115	Renal Failure/Nephritis	1,363	21,506
21.0	76	Coma and Encephalopathy	192	21,007
19.5	75	Polyneuropathy	244	19,526
18.5	55	Blood/Immune Disorders	944	18,504
18.0	17	Cancer of Placenta/Ovary/Uterine Adnexa	215	18,180
18.0	108	Gram-Negative/Staphylococcus Pneumonia	3,449	18,152
18.0	34	Cirrhosis, Other Liver Disorders	626	18,056
18.0	72	Paralytic and Other Neurologic Disorders	783	18,024
17.5	89	Congestive Heart Failure	16,952	17,672
17.5	95	Atherosclerosis of Major Vessel	2,260	17,533
16.5	66	Personality Disorders	155	16,777
16.0	105	Chronic Obstructive Pulmonary Disease	8,964	16,382
15.5	29	Adrenal Gland, Metabolic Disorders	211	15,842
15.5	70	Degenerative Neurologic Disorders	626	15,652
15.5	13	Lung Cancer	1,242	15,611
15.0	119	Urinary Tract Infection	4,981	15,301
15.0	8	Mouth/Pharynx/Larynx/Other Respiratory Cancer	309	15,300
15.0	144	Spinal Cord Injury	62	15,108
15.0	2	Septicemia (Blood Poisoning)/Shock	4,223	15,061
14.5	61	Paranoia and Other Psychoses	965	14,528
14.0	58	Delirium/Hallucinations	647	14,091
14.0	63	Anxiety Disorders	265	14,067
13.5	111	Pulmonary Fibrosis and Bronchiectasis	323	13,770
13.5	10	Stomach, Small Bowel, Other Digestive Cancer	338	13,727
13.5	99	Thrombophlebitis	311	13,613
13.5	73	Epilepsy and Other Seizure Disorders	1,848	13,577
13.5	28	Disorders of Fluid/Electrolyte/Acid-Base Balance	5,408	13,528
13.0	60	Major Depression/Manic and Depressive Disorders	5,076	13,220
13.0	57	Drug/Alcohol Psychoses	759	13,076
13.0	113	Pleural Effusion/Pneumothorax/Empyema	728	13,057
13.0	26	Diabetes with Acute Complications/Hypoglycemic Coma	525	13,023
13.0	12	Rectal Cancer	687	13,003
12.5	91	Cerebral Hemorrhage	981	12,818

Table 4-2 (continued)

PIPDCG Sorting Algorithm, No Exclusions of PIPDxGs

Preliminary PIPDCG	PIPDXG	PIPDxG Label	Frequency	Mean
12.5	93	Stroke	8,589	12,780
12.5	6	Late Effects	81	12,744
12.5	98	Peripheral Vascular Disease	974	12,683
12.5	100	Hypotension	824	12,659
12.5	114	Other Lung Disorders	438	12,633
12.5	56	Dementia	2,426	12,589
12.5	41	Inflammatory Bowel Disease	372	12,541
12.0	48	Rheumatoid Arthritis and Connective Tissue Disease	874	12,390
12.0	142	Nervous/Musculoskeletal System Symptoms	269	12,249
12.0	49	Bone/Joint Infections/Necrosis	875	12,047
12.0	54	Iron Deficiency Anemia and Other/Unspecified Blood	1,030	12,033
11.5	22	Benign Brain/Nervous System Neoplasm	231	11,764
11.0	19	Cancer of Bladder, Kidney, Urinary Organs	1,194	11,486
11.0	45	Gastrointestinal Hemorrhage	1,851	11,436
11.0	133	Cellulitis and Bullous Skin Disorders	3,299	11,387
11.0	87	Paroxysmal Ventricular Tachycardia	638	11,339
11.0	53	Other Bone Disorders	2,232	11,272
11.0	109	Bacterial Pneumonia	10,678	11,126
11.0	101	Other Circulatory Disease	697	11,123
11.0	71	Essential Tremor and Other Abnormal Movement Disord	71	11,108
10.5	118	Urethral Stricture/Hydronephrosis/Other Renal, Uret	396	10,531
10.5	42	Gastrointestinal Obstruction/Perforation	4,383	10,531
10.5	157	Complications of Medical Procedures and Care	5,877	10,507
10.5	160	Rehabilitation	4,445	10,501
10.0	161	Radiation Therapy	67	10,389
10.0	59	Schizophrenic Disorders	2,983	10,332
10.0	138	Fever	407	10,260
10.0	164	History of Serious Illness/Devices	166	10,193
10.0	25	Diabetes with No or Unspecified Complications	1,032	10,091
9.5	4	Tuberculosis	76	9,965
9.5	143	Vertebral Fracture Without Spinal Cord Injury	654	9,898
9.5	11	Colon Cancer	1,675	9,780
9.5	145	Fractures of Skull/Face	175	9.659
9.5	135	Other Dermatological Disorders	224	9,627
9.5	81	Post-Myocardial Infarction	344	9,624
9.5	83	Unstable Angina	4,295	9,571
9.5	94	Transient Cerebral Ischemia	3,457	9,552
9.5	106	Bronchitis, Except Chronic	1,395	9,539
9.0	47	Gout/Arthropathy/Derangements	714	9,531
9.5	37	Stomach Disorders	2,688	9,526
9.0	21	Other Cancers	269	9,498
9.0	97	Thromboembolic Vascular Disease	3,228	9,226
9.0	171	Major Congenital Disorders	121	9,171
9.0	146	Pelvic Fracture	722	9,150
9.0	136	General Symptoms	1,077	9,092

Table 4-2 (continued)

PIPDCG Sorting Algorithm, No Exclusions of PIPDxGs

Preliminary PIPDCG	PIPDXG	PIPDxG Label	Frequency	Mean
8.5	82	Acute Myocardial Infarction	6,720	8,933
8.5	147	Hip Fracture	5,966	8,925
8.5	150	Internal Injuries/Traumatic Amputations/Third Degree Burns	360	8,899
8.5	5	Other Infectious Disease	1,704	8,884
8.5	68	Other Mental Disorders/Substance Misuse	591	8,849
8.5	116	Kidney Infection	723	8,830
8.5	139	Respiratory, Other Chest Symptoms	411	8,822
8.5	156	Other Injuries	1,577	8,625
8.5	86	Atrial Arrhythmia	4,815	8,525
8.0	77	Valvular and Rheumatic Heart Disease	925	8,359
8.0	46	Anal/Rectal/Other Intestinal Disorders	1,835	8,302
8.0	32	Pancreatitis/Other Pancreatic Disorders	1,333	8,297
8.0	92	Precerebral Arterial Occlusion	3,442	8,216
8.0	154	Concussion, Other Head Injury	298	8,196
8.0	80	Coronary Atherosclerosis	10,091	8,180
8.0	85	Heart Rhythm and Conduction Disorders	3,306	8,134
8.0	102	Eye Disorders	830	8,107
8.0	137	Altered Consciousness/Amnesia/Fainting	2,827	8,094
3.5	90	Other Heart Diagnoses	25	8,089
8.0	141	Urinary System/Abdominal-Pelvis Symptoms	1,183	8,048
8.0	120	Other Urinary System Disorders	565	8,038
7.5	65	Nondependent Alcohol/Drug Abuse	112	7,833
7.5	43	Diverticula of Intestine	3,028	7,711
7.5	155	Poisoning/Toxic Effects	726	7,689
7.5	36	Peptic Ulcer	2,400	7,680
7.5	24	Carcinoma in Situ/Neoplasm of Uncertain Behavior/Sk	602	7,671
7.5	16	Cancer of Uterus/Cervix/Female Genital Organs	607	7,663
7.5	69	Headache	164	7,647
7.5	74	Mononeuropathy	239	7,617
7.5	110	Asthma	823	7,613
7.5	158	Artificial Opening of Gastrointestinal Tract Status	307	7,607
7.0	153	Brain Injury	282	7,600
7.5	62	Non-Psychotic Depression	291	7,548
7.5	35	Diseases of Esophagus	1,582	7,514
7.0	96	Aortic and Other Arterial Aneurysm	1,049	7,512
7.0	107	Viral Pneumonia/Influenza/Pleurisy	339	7,511
7.5	78	Hypertension, Uncomplicated	546	7,501
3.5	127	Miscarriage/Terminated Pregnancy	9	7,428
3.5	172	Other Congenital Disorders	43	7,403
7.0	79	Hypertension, Complicated	341	7,188
7.0	84	Angina Pectoris	971	7,078
7.0	39	Abdominal Hernia, Complicated	548	7,018
6.5	165	Aftercare/Screening/Observation/Special Exams	231	6,895
6.5	51	Back Disorders	3,716	6,813
6.5	64	Alcohol/Drug Dependence	935	6,674

Table 4-2 (continued)

PIPDCG Sorting Algorithm, No Exclusions of PIPDxGs

Preliminary PIPDCG	PIPDXG	PIPDxG Label	Frequency	Mean
6.5	140	Cardiovascular Symptoms	4,323	6,670
6.5	122	Other Disorders of the Male Genital Organs	344	6,607
6.5	52	Disorders of Soft Tissue	803	6,601
6.5	31	Other Endocrine, Metabolic, Nutritional Disorders	539	6,589
6.0	1	Central Nervous System Infections	112	6,351
6.0	40	Abdominal Hernia, Uncomplicated	1,504	6,272
6.0	104	Nose, Throat, and Mouth Disorders	542	6,230
6.0	149	Major Dislocations and Other Major Fractures	821	6,198
5.5	18	Cancer of Prostate/Testis/Male Genital Organs	1,638	5,897
5.5	44	Gallbladder Disorders	4,176	5,819
5.5	152	Sprains	695	5,765
5.5	14	Breast Cancer	1,790	5,644
5.5	123	Menopausal and Post-Menopausal Disorders	99	5,621
5.5	151	Open Wounds/Crushing Injury	318	5,571
5.5	121	Hyperplasia of Prostate	2,558	5,546
5.0	50	Osteoarthritis	6,326	5,321
5.0	23	Benign Neoplasm, Except Brain/Nervous System	1,348	5,310
5.0	148	Lower Limb Fracture	1,320	5,304
5.0	103	Ear Disorders	625	5,031
4.5	117	Renal/Ureteral/Bladder Calculus	949	4,910
4.0	124	Disorders of the Female Genital Organs	1,030	4,331
4.0	38	Appendicitis	391	4,237
3.5	126	Ectopic Pregnancy	9	4,085
3.5	0	No Inpatient Admission	1,128,742	3,882
3.5	125	Genital Prolapse	2,175	3,476
3.5	131	Ongoing Pregnancy with Complications	88	3,053
3.5	129	Completed Pregnancy with Complications	71	2,925
3.5	132	Ongoing Pregnancy with No or Minor Complicatons	70	2,697
3.5	67	Mental Retardation	13	2,022
3.5	159	Tracheostomy Status/Respirator Dependence	2	1,944
3.5	130	Completed Pregnancy without Complications (Normal Delivery)	26	1,473
3.5	128	Completed Pregnancy with Major Complications	19	1,435
-	163	Major Organ Transplant Status	-	-
-	166	Extremely Low Birthweight Neonates	-	-
-	167	Very Low Birthweight Neonates	-	-
-	168	Serious Perinatal Problem Affecting Newborn	-	-
-	169	Other Perinatal Problems Affecting Newborn	-	-
-	170	Normal, Single Birth	-	-

OUTPUT: DIAG107A.OUT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims.

Table 4-3

PIPDCG Sorting Algorithm, With Exclusions of PIPDxGs

Preliminary PIPDCG	PIPDXG	PIPDxG Label	Frequency	Mean
30.5	3	HIV/AIDS	435	30,614
29.5	15	Blood, Lymphatic Cancers/Neoplasms	1,040	29,756
27.5	20	Brain/Nervous System Cancer	121	27,522
26.0	7	Metastatic Cancer	1,946	26,314
24.5	134	Decubitus and Chronic Skin Ulcers	1,386	24,995
24.5	9	Liver/Pancreas/Esophagus Cancer	339	24,703
23.5	33	End Stage Liver Disorders	243	23,904
23.5	88	Cardio-Respiratory Failure and Shock	2,490	23,621
22.5	27	Diabetes with Chronic Complications	2,565	22,743
22.0	112	Aspiration Pneumonia	1,794	22,002
21.5	115	Renal Failure/Nephritis	1,364	21,580
20.5	76	Coma and Encephalopathy	190	20,646
19.5	75	Polyneuropathy	244	19,526
19.0	17	Cancer of Placenta/Ovary/Uterine Adnexa	265	19,333
18.5	55	Blood/Immune Disorders	950	18,554
18.0	108	Gram-Negative/Staphylococcus Pneumonia	3,456	18,171
18.0	72	Paralytic and Other Neurologic Disorders	786	18,107
17.5	34	Cirrhosis, Other Liver Disorders	620	17,914
17.5	89	Congestive Heart Failure	16,989	17,675
17.5	95	Atherosclerosis of Major Vessel	2,264	17,561
16.5	8	Mouth/Pharynx/Larynx/Other Respiratory Cancer	346	16,814
16.5	66	Personality Disorders	155	16,777
16.0	13	Lung Cancer	1,382	16,496
16.0	105	Chronic Obstructive Pulmonary Disease	8,965	16,373
15.5	29	Adrenal Gland, Metabolic Disorders	210	15,855
15.5	70	Degenerative Neurologic Disorders	624	15,645
15.0	144	Spinal Cord Injury	62	15,108
15.0	2	Septicemia (Blood Poisoning)/Shock	4,234	15,099
14.5	58	Delirium/Hallucinations	686	14,629
14.5	61	Paranoia and Other Psychoses	967	14,549
14.0	63	Anxiety Disorders	263	14,333
13.5	10	Stomach, Small Bowel, Other Digestive Cancer	354	13,940
13.5	73	Epilepsy and Other Seizure Disorders	1,904	13,900
13.5	111	Pulmonary Fibrosis and Bronchiectasis	324	13,888
13.5	12	Rectal Cancer	744	13,757
13.5	26	Diabetes with Acute Complications/Hypoglycemic Coma	559	13,663
13.5	4	Tuberculosis	100	13,581
13.0	91	Cerebral Hemorrhage	1,039	13,428
13.0	113	Pleural Effusion/Pneumothorax/Empyema	743	13,337
13.0	60	Major Depression/Manic and Depressive Disorders	5,213	13,320
13.0	57	Drug/Alcohol Psychoses	772	13,128
13.0	93	Stroke	8,984	13,075
12.5	98	Peripheral Vascular Disease	978	12,760
12.5	56	Dementia	2,462	12,596
12.5	48	Rheumatoid Arthritis and Connective Tissue Disease	905	12,559

Table 4-3 (continued)

PIPDCG Sorting Algorithm, With Exclusions of PIPDxGs

Preliminary PIPDCG	PIPDXG	PIPDxG Label	Frequency	Mean
12.0	22	Benign Brain/Nervous System Neoplasm	242	12,368
12.0	49	Bone/Joint Infections/Necrosis	893	12,152
12.0	41	Inflammatory Bowel Disease	369	12,125
12.0	19	Cancer of Bladder, Kidney, Urinary Organs	1,285	12,125
11.5	45	Gastrointestinal Hemorrhage	1,960	11,810
11.5	133	Cellulitis and Bullous Skin Disorders	3,418	11,778
11.5	87	Paroxysmal Ventricular Tachycardia	662	11,569
11.0	109	Bacterial Pneumonia	10,904	11,213
11.0	42	Gastrointestinal Obstruction/Perforation	4,721	11,094
10.5	143	Vertebral Fracture Without Spinal Cord Injury	782	10,889
10.5	59	Schizophrenic Disorders	3,053	10,517
10.0	97	Thromboembolic Vascular Disease	3,752	10,262
10.0	11	Colon Cancer	1,833	10,127
10.0	81	Post-Myocardial Infarction	378	10,111
10.0	116	Kidney Infection	849	10,067
10.0	83	Unstable Angina	4,546	10,017
9.5	94	Transient Cerebral Ischemia	3,610	9,818
9.5	147	Hip Fracture	7,697	9,669
9.5	21	Other Cancers	303	9,631
9.5	145	Fractures of Skull/Face	203	9,575
9.0	32	Pancreatitis/Other Pancreatic Disorders	1,501	9,429
9.0	146	Pelvic Fracture	808	9,325
9.0	82	Acute Myocardial Infarction	7,154	9,192
9.0	150	Internal Injuries/Traumatic Amputations/Third Degree Burns	395	9,122
8.5	77	Valvular and Rheumatic Heart Disease	1,089	8,820
8.5	158	Artificial Opening of Gastrointestinal Tract Status	388	8,676
8.5	86	Atrial Arrhythmia	4,979	8,586
8.5	92	Precerebral Arterial Occlusion	3,798	8,552
8.5	84	Angina Pectoris	1,310	8,551
8.5	80	Coronary Atherosclerosis	11,163	8,549
8.0	16	Cancer of Uterus/Cervix/Female Genital Organs	673	8,453
8.0	96	Aortic and Other Arterial Aneurysm	1,219	8,374
8.0	36	Peptic Ulcer	2,670	8,369
8.0	153	Brain Injury	375	8,287
8.0	79	Hypertension, Complicated	407	8,274
8.0	110	Asthma	888	8,116
7.5	1	Central Nervous System Infections	136	7,893
7.0	39	Abdominal Hernia, Complicated	631	7,439
7.0	64	Alcohol/Drug Dependence	1,069	7,037
6.0	18	Cancer of Prostate/Testis/Male Genital Organs	1,822	6,443
4.0	127	Miscarriage/Terminated Pregnancy	12	6,036
5.5	14	Breast Cancer	1,929	5,852
4.0	0	No or Excluded Inpatient Admission*	1,210,130	4,135
4.0	126	Ectopic Pregnancy	11	3,954
4.0	131	Ongoing Pregnancy with Complications	91	2,991

Table 4-3 (continued)

PIPDCG Sorting Algorithm, With Exclusions of PIPDxGs

Preliminary PIPDCG	PIPDXG	PIPDxG Label	Frequency	Mean
4.0	129	Completed Pregnancy with Complications	73	2,872
4.0	132	Ongoing Pregnancy with No or Minor Complicatons	72	2,629
4.0	128	Completed Pregnancy with Major Complications	20	1,471
4.0	130	Completed Pregnancy without Complications (Normal Delivery)	29	1,419

* See Table 3-1 for excluded diagnoses.

OUTPUT: DIAG112A.OUT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims.

Table 4-4

Diagnoses (PIPDxGs) Included in Each PIPDCG, Payment Model

PIPDCG 29

3	HIV/AIDS[a]
15	Blood, Lymphatic Cancers/Neoplasms[b]

PIPDCG 26

7	Metastatic Cancer[b]
20	Brain/Nervous System Cancer[b]

PIPDCG 23

9	Liver/Pancreas/Esophagus Cancer[b]
33	End Stage Liver Disorders
88	Cardio-Respiratory Failure and Shock
134	Decubitus and Chronic Skin Ulcers

PIPDCG 20

27	Diabetes with Chronic Complications
76	Coma and Encephalopathy
112	Aspiration Pneumonia
115	Renal Failure/Nephritis

PIPDCG 18

17	Cancer of Placenta/Ovary/Uterine Adnexa[b]
55	Blood/Immune Disorders
72	Paralytic and Other Neurologic Disorders
75	Polyneuropathy
108	Gram-Negative/Staphylococcus Pneumonia

PIPDCG 16

8	Mouth/Pharynx/Larynx/Other Respiratory Cancer[b]
13	Lung Cancer[b]
34	Cirrhosis, Other Liver Disorders
89	Congestive Heart Failure
95	Atherosclerosis of Major Vessel
105	Chronic Obstructive Pulmonary Disease

Table 4-4 (continued)

Diagnoses (PIPDxGs) Included in Each PIPDCG, Payment Model

PIPDCG 14

2	Septicemia (Blood Poisoning)/Shock
29	Adrenal Gland, Metabolic Disorders
58	Delirium/Hallucinations
61	Paranoia and Other Psychoses
63	Anxiety Disorders
66	Personality Disorders
70	Degenerative Neurologic Disorders
144	Spinal Cord Injury

PIPDCG 12

4	Tuberculosis
10	Stomach, Small Bowel, Other Digestive Cancer[b]
12	Rectal Cancer[b]
19	Cancer of Bladder, Kidney, Urinary Organs
22	Benign Brain/Nervous System Neoplasm
26	Diabetes with Acute Complications/Hypoglycemic Coma
41	Inflammatory Bowel Disease
48	Rheumatoid Arthritis and Connective Tissue Disease
49	Bone/Joint Infections/Necrosis
56	Dementia
57	Drug/Alcohol Psychoses
60	Major Depression/Manic and Depressive Disorders
73	Epilepsy and Other Seizure Disorders
91	Cerebral Hemorrhage
93	Stroke
98	Peripheral Vascular Disease
111	Pulmonary Fibrosis and Bronchiectasis
113	Pleural Effusion/Pneumothorax/Empyema

PIPDCG 11

42	Gastrointestinal Obstruction/Perforation
45	Gastrointestinal Hemorrhage
87	Paroxysmal Ventricular Tachycardia
109	Bacterial Pneumonia
133	Cellulitis and Bullous Skin Disorders

Table 4-4 (continued)

Diagnoses (PIPDxGs) Included in Each PIPDCG, Payment Model

PIPDCG 10

11	Colon Cancer[b]
59	Schizophrenic Disorders
81	Post-Myocardial Infarction
83	Unstable Angina
97	Thromboembolic Vascular Disease
116	Kidney Infection
143	Vertebral Fracture Without Spinal Cord Injury

PIPDCG 9

21	Other Cancers[b]
32	Pancreatitis/Other Pancreatic Disorders
82	Acute Myocardial Infarction
94	Transient Cerebral Ischemia
145	Fractures of Skull/Face
146	Pelvic Fracture
147	Hip Fracture
150	Internal Injuries/Traumatic Amputations/Third Degree Burns

PIPDCG 8

16	Cancer of Uterus/Cervix/Female Genital Organs[b]
36	Peptic Ulcer
77	Valvular and Rheumatic Heart Disease
79	Hypertension, Complicated
80	Coronary Atherosclerosis
84	Angina Pectoris
86	Atrial Arrhythmia
92	Precerebral Arterial Occlusion
96	Aortic and Other Arterial Aneurysm
110	Asthma
153	Brain Injury
158	Artificial Opening of Gastrointestinal Tract Status

PIPDCG 7

1	Central Nervous System Infections
39	Abdominal Hernia, Complicated
64	Alcohol/Drug Dependence

Table 4-4 (continued)

Diagnoses (PIPDxGs) Included in Each PIPDCG, Payment Model

PIPDCG 6

18	Cancer of Prostate/Testis/Male Genital Organs[b]

PIPDCG 5

14	Breast Cancer[b]
131	Ongoing Pregnancy with Complications
132	Ongoing Pregnancy with No or Minor Complications

PIPDCG 4

0	No or Excluded* Inpatient Admissions
126	Ectopic Pregnancy
127	Miscarriage/Terminated Pregnancy
128	Completed Pregnancy with Major Complications
129	Completed Pregnancy with Complications
130	Completed Pregnancy without Complications (Normal Delivery)

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[a] Includes principal and secondary inpatient diagnoses of HIV/AIDS.

[b] Includes principal diagnoses and secondary diagnoses when the principal diagnosis is chemotherapy. See text.

*See Table 3-1 for diagnoses excluded from the payment model.

SOURCE: Health Economics Research, Inc.

Table 4-5

PIPDCG Model With PIPDxG Exclusions

Model:	1	2 = BASE
	AGESEX	AGESEX + PIPDCGs w/ Exclusions†
Number of Observations:	1,387,105	1,387,105
R-Squared:	0.008679	0.058021
Dependent Variable Mean:	5,186	5,186
Root Mean Square Error:	13,946	13,595
Model Parameters:	24	39
Computer Output:	DIAG99G NEW	DIAG112B NEW

Variable	beta	t-ratio	beta	t-ratio
AGE/SEX GROUPS:				
MALE: 0-34	3,398	25.71	2,237	17.34
MALE: 35-44	3,893	40.38	2,660	28.20
MALE: 45-54	4,081	45.42	3,031	34.55
MALE: 55-59	4,777	38.51	3,571	29.51
MALE: 60-64	5,496	50.00	4,200	39.15
MALE: 65-69	3,989	92.59	3,206	76.04
MALE: 70-74	4.762	124.57	3,876	103.35
MALE: 75-79	5,934	134.24	4,842	111.67
MALE: 80-84	7,041	125.91	5,677	103.56
MALE: 85-89	8,115	98.49	6,561	81.41
MALE: 90-94	8,813	60.68	7,136	50.33
MALE: 95+	8,862	30.32	7,153	25.09
FEMALE: 0-34	3,685	21.88	2,437	14.83
FEMALE: 35-44	4,211	33.91	3,002	24.77
FEMALE: 45-54	4,598	41.78	3,459	32.21
FEMALE: 55-59	5,464	38.48	4,156	30.00
FEMALE: 60-64	6,707	54.24	5,270	43.67
FEMALE: 65-69	3,481	89.87	2,827	74.67
FEMALE: 70-74	4,117	125.18	3,367	104.50
FEMALE: 75-79	5,141	143.35	4,182	118.79
FEMALE: 80-84	6,226	150.49	5,039	123.91
FEMALE: 85-89	7,241	136.57	5,838	112.12
FEMALE: 90-94	7,720	97.30	6,158	79.26
FEMALE: 95+	7,323	54.40	5,862	44.61
PIPDCGs:				
5	-	-	1,694	5.60
6	-	-	2,207	6.75
7	-	-	3,642	11.34
8	-	-	4,170	50.18
9	-	-	4,777	49.67
10	-	-	6,087	53.55
11	-	-	6,692	69.05
12	-	-	8,685	101.26
14	-	-	10,554	62.61
16	-	-	12,641	150.69
18	-	-	13,903	72.49
20	-	-	17,685	92.85
23	-	-	19,868	89.31
26	-	-	22,318	60.73
29	-	-	26,235	65.57

† PIPDCG 4 is the omitted category, which includes all persons without 1995 hospital admissions, or excluded or certain low-cost admissions only.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 4-6

PIPDCG Models With and Without Exclusions

Model:	1 = Base		2	
	AGESEX + PIPDCGs w/ Exclusions[†]		AGESEX + PIPDCGs w/o Exclusions[††]	
Number of Observations:	1,387,105		1,387,105	
R-Squared:	0.058021		0.063408	
Dependent Variable Mean:	5,186		5,186	
Root Mean Square Error:	13,595		13,556	
Model Parameters:	39		41	
Computer Output:	DIAG112B.NEW		DIAG107B.OU2	
Variable	**beta**	**t-ratio**	**beta**	**t-ratio**
AGE/SEX GROUPS:				
MALE: 0-34	2,237	17.34	2,119	16.47
MALE: 35-44	2,660	28.20	2,501	26.60
MALE: 45-54	3,031	34.55	2,841	32.47
MALE: 55-59	3,571	29.51	3,359	27.83
MALE: 60-64	4,200	39.15	3,985	37.23
MALE: 65-69	3,206	76.04	3,057	72.61
MALE: 70-74	3,876	103.35	3,699	98.67
MALE: 75-79	4,842	111.67	4,611	106.33
MALE: 80-84	5,677	103.56	5,389	98.34
MALE: 85-89	6,561	81.41	6,202	77.07
MALE: 90-94	7,136	50.33	6,738	47.64
MALE: 95+	7,153	25.09	6,724	23.65
FEMALE: 0-34	2,437	14.83	2,291	13.98
FEMALE: 35-44	3,002	24.77	2,774	22.95
FEMALE: 45-54	3,459	32.21	3,159	29.48
FEMALE: 55-59	4,156	30.00	3,847	27.84
FEMALE: 60-64	5,270	43.67	4,950	41.11
FEMALE: 65-69	2,827	74.67	2,648	69.97
FEMALE: 70-74	3,367	104.50	3,162	98.01
FEMALE: 75-79	4,182	118.79	3,923	111.25
FEMALE: 80-84	5,039	123.91	4,716	115.77
FEMALE: 85-89	5,838	112.12	5,446	104.54
FEMALE: 90-94	6,158	79.26	5,725	73.79
FEMALE: 95+	5,862	44.61	5,452	41.59
PIPDCGs:				
4	-	-	988	3.52
5	1,694	5.60	1,570	16.41
6	2,207	6.75	2,752	23.45
7	3,642	11.34	3,484	30.57
8	4,170	50.18	4,207	65.52
9	4,777	49.67	5,229	53.95
10	6,087	53.55	6,369	63.42
11	6,692	69.05	6,774	68.53
12	8,685	101.26	8,748	111.81
14	10,554	62.61	10,711	85.75
16	12,641	150.69	12,906	149.27
18	13,903	72.49	14,103	77.22
20	17,685	92.85	17,931	94.35
23	19,868	89.31	20,092	104.07
26	22,318	60.73	24,286	45.23
29	26,235	65.57	27,262	54.95
40	-	-	40,123	36.42

[†] PIPDCG 4 is the omitted category, which includes all persons without 1995 hospital admissions, or excluded or certain low-cost admissions only.

[††] PIPDCG 3 is the omitted category, which includes all persons without 1995 hospital admissions, or certain low-cost admissions only.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data

Table 4-7

Number of Admissions Used in Different Stages of PIPDCG Modeling

Admissions in 1995	Number of Admissions	Percentage	Percentage of Admissions in PIPDCG Sorting Algorithm
Total Admissions[1]	415,231	100.0 %	-
Excluded Admissions due to exclusions of PIPDXG	153,276	36.9	-
- Admissions of people with an included admission	55,210	13.3	
- Admissions of people without an included admission	98,066	23.6	
Remaining Admissions Participate in the PIPDCG Sorting Algorithm	261,955	63.1	100.0 %
- exclusions due to multiple admissions per person[2]	85,389	20.6	32.6
Excluded short stays admissions[3]	8,889	2.1	3.4
Admissions Used to Define PIPDCG[4]	167,677	40.4	64.0

[1] There were 258,363 persons with at least one admission in 1995.

[2] For a person with multiple admissions in 1995, only the admission with the highest future cost is used to determine the person's PIPDCG. However, one person may have multiple admissions for the same principal inpatient diagnosis

[3] 0 or 1 day stays

[4] The PIPDCG model with exclusions and excluding 0 or 1 day stays

OUTPUT: DIAG114A.OUT, DIAG114C.OUT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data

Table 4-8

Descriptive Statistics on PIPDCGs With Exclusions

	PIPDCG	Frequency	Percentage of Sample	Percentage of Those Hospitalized in 1995	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
Entire Sample	-	1,387,105	100.00	-	5,186	12	274
At least one admission	-	258,367	18.63	100.00	11,150	45	197
	4*	1,210,275	87.25	-	4,134	11	286
	5	2,082	0.15	0.81	5,622	249	200
	6	1,822	0.13	0.71	6,443	311	201
	7	1,835	0.13	0.71	7,236	308	181
	8	28,199	2.03	10.91	8,459	109	212
	9	21,579	1.56	8.35	9,471	139	210
	10	15,065	1.09	5.83	10,198	151	178
	11	21,540	1.55	8.34	11,315	155	195
	12	27,566	1.99	10.67	13,011	140	173
	14	7,170	0.52	2.78	15,005	311	168
	16	30,358	2.19	11.75	17,152	175	167
	18	5,701	0.41	2.21	18,338	415	161
	20	5,913	0.43	2.29	22,202	464	149
	23	4,458	0.32	1.73	24,142	626	159
	26	2,067	0.15	0.80	26,374	958	134
	29	1,475	0.11	0.57	30,027	1,539	174
	Sum of 5-29†	176,830	12.75	68.44	-	-	-

*Contains people with no 1995 hospital admissions, excluded admissions only, and certain other low cost admissions only

†Contains all people whose hospital admission (diagnosis) results in a higher capitation payment the following year

OUTPUT. DIAG1120

SOURCE: Health Economics Research, Inc analysis of 1995 and 1996 Medicare claims data.

Table 4-8A

Descriptive Statistics on PIPDCGs With Diagnostic Exclusions and Short Stays Excluded

	PIPDCG	Frequency	Percentage of Sample	Percentage of Those Hospitalized* in 1995	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
Entire Sample	-	1,387,105	100.00	-	5,186	12	274
At least one admission*	-	241,495	17.41	100.00	11,472	47	194
	4**	1,217,773	87.79	-	4,162	11	285
	5	1,677	0.12	0.69	5,897	292	200
	6	1,640	0.12	0.68	6,489	338	206
	7	1,771	0.13	0.73	7,406	315	177
	8	25,977	1.87	10.76	8,628	116	213
	9	21,077	1.52	8.73	9,540	139	206
	10	14,226	1.03	5.89	10,366	158	179
	11	21,012	1.51	8.70	11,427	161	196
	12	26,592	1.92	11.01	13,124	142	171
	14	7,016	0.51	2.91	15,102	317	168
	16	29,378	2.12	12.17	17,348	178	166
	18	5,611	0.40	2.32	18,381	415	159
	20	5,731	0.41	2.37	22,385	473	149
	23	4,339	0.31	1.80	24,294	641	159
	26	1,869	0.13	0.77	26,461	975	129
	29	1,416	0.10	0.59	30,456	1,597	175
	Sum of 5-29†	169,332	12.21	70.12	-	-	-

* With length of stay greater than one day.

** Contains people with no 1995 hospital admissions, excluded admissions only, short-stay admissions only, and certain other low cost admissions only.

† Contains all people whose hospital admission (diagnosis) results in a higher capitation payment the following year.

OUTPUT: DIAG1230.OUT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 4-9

Descriptive Statistics on PIPDCGs Without Exclusions

	PIPDCG	Frequency	Percentage of Sample	Percentage of Those Hospitalized in 1995	Mean 1996 Expenditures	Standard Error of the Mean	Coefficient of Variation (*100)
Entire Sample	-	1,387,105	100.00	-	5,186	12	274
At least one admission	-	258,367	18.63	100.00	11,150	45	197
	3*	1,131,214	81.55	-	3,881	11	294
	4	2,370	0.17	0.92	4,546	220	234
	5	20,806	1.50	8.05	5,520	83	214
	6	13,775	0.99	5.33	6,590	120	211
	7	14,761	1.06	5.71	7,540	132	210
	8	48,343	3.49	18.71	8,396	83	214
	9	20,833	1.50	8.06	9,439	127	191
	10	19,209	1.38	7.43	10,306	143	189
	11	20,552	1.48	7.95	11,110	152	190
	12	33,249	2.40	12.87	12,888	128	175
	14	13,315	0.96	5.15	14,999	231	168
	16	28,204	2.03	10.92	17,179	179	165
	18	6,255	0.45	2.42	18,232	400	163
	20	5,906	0.43	2.29	22,184	464	150
	23	6,252	0.45	2.42	24,112	532	155
	26	832	0.06	0.32	28,375	2,200	196
	29	1,033	0.07	0.40	30,859	1,465	130
	40	196	0.01	0.08	42,724	4,939	142

*Contains people with no 1995 hospital admissions, and certain other low cost admissions only.

OUTPUT. DIAG1070

SOURCE: Health Economics Research, Inc analysis of 1995 and 1996 Medicare claims data.

5

Ever Disabled and Medicaid Demographic Factors

The base PIPDCG model from Chapter 4 (Model 2, Table 4-5) includes age and sex only in addition to prior year hospital diagnoses. In this chapter, we analyze adding two additional demographic risk adjusters to the base model. They are:

- Ever disabled status; and
- Medicaid status.

Two more demographic factors, working aged and institutional status, are discussed in Chapters 6 and 7, respectively. With the exception of 'ever disabled' status, all these demographic adjusters are currently used in Medicare's AAPCC methodology.

In this chapter, we first discuss the rationale for including ever disabled and Medicaid adjusters. Then we present descriptive statistics on actual versus predicted payments for people in these statuses, showing that a model with age, sex, and PIPDCGs underpredicts Medicare payments for these groups. Next, we analyze the effect of adding ever disabled and Medicaid status to age/sex and PIPDCG models. The new base PIPDCG model incorporating ever disabled and Medicaid is then presented in an actuarial rate cell format and compared to HCFA's current AAPCC model. The following section analyzes alternative specifications of the Medicaid and ever disabled adjustments in the PIPDCG model. We conclude with our recommendations for use of these factors in Medicare risk adjustment. Additional details on file construction and variable definition are contained in Chapter 2.

5.1 Ever Disabled and Medicaid Status

'Ever disabled' status indicates a Medicare beneficiary who is currently (1996) entitled by reason of age (65 or over), but whose 'original reason for entitlement' was disability. That is, the ever disabled are elderly beneficiaries who were originally enrolled in Medicare because of disability and have 'aged into' aged entitlement status. Currently, ever disabled is not an AAPCC risk adjustment factor, but it is plausible that the ever disabled may have higher Medicare expenditures than the 'never disabled', elders who were not previously entitled by reason of disability. Note that 'disability' in this context refers to an entitlement status, not to functional status. Many elderly with functional disabilities (such as difficulty in walking) have never been entitled to Medicare benefits on the basis of disability. The entitlement status of disability and the functional status of disability may be correlated, however.

Medicare-Medicaid dual eligibles enrolled in fee-for-service have higher Medicare expenditures than non-dual-eligibles. In the AAPCC methodology, Medicaid status is a concurrent adjustment factor for Medicare capitation payments. A Medicare beneficiary is placed into an AAPCC 'rate cell' payment category each month based on his or her current Medicaid enrollment status. In contrast, we interpret Medicaid status primarily as a poverty or low income/wealth indicator for a person, which is likely to persist. Hence, we define Medicaid status prospectively, as state Medicaid buy-in for all or part of 1995. We also present selected results based on concurrent Medicaid status for comparison. As explained in Chapter 2, our analysis distinguishes four Medicaid subgroups: (1) Qualified Medicare

Beneficiaries (QMBs)only; (2) Specified Low Income Medicare Beneficiaries (SLMBs); (3) Medically Needy or 'spend downs'; and (4) Supplemental Security Income (SSI) and other 'full benefit' dual eligibles.

5.2 Actual Expenditures Compared to Expenditures Predicted by the Base PIPDCG Model

Table 5-1 presents mean actual expenditures and mean predicted expenditures by Medicaid and ever disabled status. Mean predicted expenditures are from the base PIPDCG model (Model 2 from Table 4-5), which includes age, sex, and principal hospital diagnoses. Mean actual 1996 annualized payments for the overall sample are $5,186, which are predicted exactly by the base PIPDCG model, as expected. More than three quarters of Medicare beneficiaries (77%) are non-Medicaid and never disabled, with a mean actual payment of $4,015 and a mean predicted payment $4,973. That is, the base PIPDCG model over-predicts payments for the non-Medicaid and never disabled, with a predictive ratio of 1.24.

About 15 percent of Medicare beneficiaries are Medicaid dual eligibles.[1] Slightly more than half (57%) of dual eligibles are SSI/other full benefit, about one-third (34%) are QMBs only, and few are medically needy (7%) or SLMBs (5%).[2] Medicaid status is associated with higher actual payments, compared to the overall sample, with a mean actual

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[1] In Table 5-1, Medicaid status is defined as having Medicaid buyin for one month or more in 1995.

[2] These percentages are based on states' reporting of these subcategories to HCFA. As discussed in Chapter 2, the reporting appears to be incomplete/inaccurate in some states. Therefore, the percentages should be regarded as approximate.

payment of $7,332. The base PIPDCG model underpredicts payments by more than 20 percent. Among Medicaid subgroups, the medically needy group has the highest mean actual payment ($8,770), followed by SLMBs ($7,808), QMBs ($7,471), and SSI and other full Medicaid benefit eligibles ($7,083). The medically needy group is expensive because it comprises individuals who have 'spent down' to Medicaid eligibility by incurring large medical expenditures. Thus, medically needy status is a proxy for recent serious health problems. Predicted expenditures are too low for all Medicaid subgroups, but the degree of underprediction does not vary much by subgroup. Predictive ratios range only from 0.76 to 0.81 across the groups. The greater relative expense of the medically needy is largely accounted for by diagnoses. The Medicaid elderly have higher actual Medicare payments than the Medicaid disabled across all Medicaid subgroups, and except for the medically needy, lower predictive ratios.

About 6 percent of Medicare beneficiaries are ever disabled. The ever disabled have considerably higher actual payments than average ($7,966 versus $5,186), and the base PIPDCG model underpredicts these expenditures by 30 percent. About one-fourth of ever disabled are also Medicaid eligibles. This group is associated with the highest actual payments ($9,882) and is the most underpredicted of any group in Table 5-1.

Table 5-1 suggests that the base PIPDCG model, with only age and sex demographic factors, does not adequately predict the average expenditures of several important, and higher-cost, Medicare subgroups. We now turn to the impact of adding ever disabled and Medicaid status to the risk adjustment regression models.

5.3 Demographic and PIPDCG Models with Ever Disabled and Medicaid Status

5.3.1 Demographic Models

Table 5-2 presents risk adjustment regression models with ever disabled and Medicaid status. The baseline age/sex Model (1) from Table 4-5 is repeated as Model (1) of Table 5-2. In Model (2) of Table 5-2, we add ever disabled and Medicaid status to the age/sex only model. Each variable is fully interacted with the age/sex cells (but not with each other).

Both Medicaid and ever disabled status are associated with significantly higher Medicare payments. Adding ever disabled and Medicaid status to the age/sex model nearly doubles its explanatory power, with the R-square rising from 0.9% to 1.5%. In addition, adding ever disabled and Medicaid status lowers the age/sex cell coefficients substantially as payments are redistributed away from age and sex to the two demographic factors.

Medicaid status adds $1,000 to $3,000 to average Medicare payments, with the incremental amounts lowest for the youngest and oldest ages. Ever disabled status also adds $1,000 to $3,000, with the amounts greater for females than males, and falling off among the older elderly. There are virtually no ever disabled in our sample who are more than 89 years old. This is presumably because the Medicare program began only in the mid-1960s, and someone who is ever disabled must have been first eligible for Medicare when under age 65. Someone who was eligible for Medicare at age 64 in 1970 would be only 90 years old in 1996. The anomalous coefficient of -$8,538 for ever disabled males age 90 to 94 is due to small sample size. There is only one person in our sample in this cell.

Adding ever disabled to the model eliminates the reduction in expected payments as a disabled person ages into elderly entitlement. For example, when a 64 year old disabled non-Medicaid male turns 65, without the ever disabled adjustment, there is a reduction in payment from $5,496 to $3,989 (Model (1) of Table 5-2). After adjusting for ever disabled, his health plan will see an increase in payment from $4,985 to $6,202 (= $3,342 + $2,860) (Model (2) of Table 5-2).

5.3.2 PIPDCG Models

In Models (3) and (4) in Table 5-2, we add ever disabled and Medicaid status to the base PIPDCG model (Model 2 from Table 4-5). Model (3) includes ever disabled status, Medicaid status interacted with disabled or elderly entitlement, and the interaction of ever disabled and Medicaid status. Even controlling for inpatient diagnosis, both Medicaid and ever disabled are significant cost factors, adding several thousand dollars to predicted payments. They raise the explanatory power of the PIPDCG model from 5.8 percent to 6.2 percent. The interaction of Medicaid and ever disabled, however, is statistically insignificant, indicating that an additive model of the joint effects of the two factors is satisfactory.

In Model (4) of Table 5-2, we fully interact Medicaid and ever disabled status with the age/sex cells. Put differently, Model (4) is the PIPDCGs added to Model (2). The pattern of the Medicaid and ever disabled coefficients by age/sex cell is similar to the pattern in the demographic Model (2), although the absolute magnitude of the coefficients is lower because

hospital diagnosis (the PIPDCGs) is included. Some random variation in the pattern of coefficients across age/sex cell is evident. This, and the lack of sufficient observations to estimate the ever disabled factor for the oldest old, indicate the need for actuarial smoothing of the coefficients before use in a payment model.

5.3.3 Rate Cell Presentation

Model (4) of Table 5-2 becomes our new 'base' model. It includes age, sex, ever disabled status, Medicaid status, and principal hospital diagnosis (PIPDCGs). This model is used for analysis of additional demographic factors (working aged, institutionalization) in Chapters 6 and 7, of excluding diagnoses from short hospital stays in Chapter 8, and is the model that is validated in Chapter 9.

Although Model (4) requires actuarial smoothing and imputation for some demographic cells before it is used for payment,[3] it is informative to express it in terms of actuarial 'rate cells'. Table 5-3 shows the rate cells implied by the base model, for the total of Part A and Part B expenditures, and for both disabled (under age 65) and elderly (age 65 and older). The national average payment is represented by 1.00, and the other rate cell amounts are relative to the national average. The Medicaid and ever disabled demographic factors employed in the base PIPDCG model imply four demographic payment groups for which factors are shown in Table 5-3 (each person falls into one and only one of these four demographic groups):

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[3] For the purposes of Table 5-3, we have assigned the coefficient of the 85-89 age group to the 90-94 and 95+ age groups of ever disabled.

1. beneficiaries who are first eligible for Medicare at age 65 or older, and who are not enrolled in Medicaid. These beneficiaries are termed the 'never disabled, non-Medicaid';
2. beneficiaries first eligible for Medicare when under age 65 who are not enrolled in Medicaid. These beneficiaries are termed 'ever disabled, non-Medicaid';
3. beneficiaries who are first eligible for Medicare at age 65 or older, and are enrolled in Medicaid. These beneficiaries are termed 'Medicaid, never disabled'; and
4. beneficiaries who are first enrolled in Medicare when under age 65, and are enrolled in Medicaid. These beneficiaries are termed 'Medicaid and ever disabled'.

The largest number of Medicare beneficiaries fall into the first category, that is, the nonpoor elderly. Medicare beneficiaries entitled by disability (who must be under age 65) fall into either the second or the fourth group. That is, disabled Medicare beneficiaries are either enrolled in Medicaid (fourth group) or not (second group). The pattern of rate cell factors by age and sex is shown for each of the four groups. For example, column (2) of Table 5-3 shows how the relative payment for a disabled beneficiary not enrolled in Medicaid changes as he or she ages into aged entitlement status.

The PIPDCG factors are added to the factor for the appropriate demographic cell. Each person is classified into one and only one PIPDCG. If a beneficiary has no included hospitalizations in the base year, they are classified into PIPDCG 4, and their payment is determined by their demographic cell only. For example, a 68 year old woman not enrolled in Medicaid and first eligible for Medicare at age 65 has a relative payment factor of 0.45, or 45 percent of the average. If this woman was hospitalized for leukemia in the year prior

to payment, however, the factor of 5.03 for PIPDCG 29 is added to her demographic amount of 0.45, for a total relative payment of 5.48, or 548 percent of average.

Several patterns are apparent from Table 5-3. First, payments generally rise with age.[4] Second, looking horizontally across the table, payments are higher for the ever disabled or Medicaid dual eligibles as compared to the first column of never disabled, non-Medicaid. Third, payment transitions when the disabled age into elderly entitlement status (columns (2) and (4)) appear reasonable. Fourth, the range of payments due to demographic factors alone is about five times (the highest demographic factor is 1.77 and the lowest is 0.35). Fifth, the difference in payments due to hospital diagnosis can be much larger than due to demographic factors. The greatest payment difference due to demographics is 1.42 (1.77-0.35) whereas the largest difference due to diagnosis is 5.03 (=5.03-0). The greatest total difference in payment is 6.80 (= demographic factor of 1.77 + PIPDCG29 factor of 5.03) versus 0.35 (= demographic factor of 0.35 + PIPDCG factor of 0) or almost 20 times.

5.3.4 Comparison of PIPDCG and AAPCC Models

It is interesting to compare the risk adjustment factors derived from the base PIPDCG model to those currently used in the AAPCC. Table 5-4 shows the 1999 AAPCC demographic cost factors for the aged, divided into Part A and Part B. The difference in risk

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[4] There are one or two anomalies in Table 5-3 with respect to age patterns that can be modified through actuarial smoothing of regression coefficients. For example, the ever disabled, non-Medicaid factor for male, 85-89 is lower than the factor for male, age 80-84. This occurs because of the steep drop in the ever disabled coefficient in Model (4) of Table 5-2 between the two age ranges. But the 85-89 year old coefficient is estimated imprecisely because of small sample sizes. Actuarial smoothing of these coefficients should result in a more normal pattern of cost increase with age.

adjustment factors is immediately apparent between Tables 5-3 (PIPDCG model) and 5-4 (AAPCC). Since the AAPCC factors of institutionalization and working aged will be analyzed in later chapters, while ever disabled does not appear in the AAPCC, the most interesting comparison at this point is between the AAPCC 'non-institutional non-Medicaid' and 'Medicaid' columns, and the 'never disabled, non-Medicaid', and 'Medicaid, never disabled' columns, respectively, in the PIPDCG model. This comparison is hampered by the division of the AAPCC into Part A and Part B, but some general patterns can be discerned.

As expected, the AAPCC factors are larger than the pure demographic factors of the PIPDCG model. For example, the Part A AAPCC factor for a 65-69 year old female, non-Medicaid, is 0.55, and the Part B factor is 0.70. The corresponding PIPDCG factor is 0.45. This is because the PIPDCG cell includes only those with no (included) hospitalizations. The AAPCC factor averages both those who were hospitalized in the base year and those who were not.[5] If the 65 to 69 year old woman had been hospitalized in the prior year for, say, breast cancer (PIPDCG 5), her total PIPDCG factor would be 0.78 (= 0.45 + 0.33), which exceeds the AAPCC factor.

The 'Medicaid effect' appears similar in the two models. For example, the ratio of the Medicaid/non-Medicaid factors for a 65 to 69 year old male (never disabled, not hospitalized, not institutionalized) is 1.81 in the PIPDCG model (=0.96/0.53) and 1.77 for the Part A AAPCC (=1.15/0.65). We will make further comparisons involving the working aged and the institutional factors in later chapters.

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[5] Although the AAPCC cell excludes the institutionalized, whereas the PIPDCG model cell does not.

5.4 Alternative Specifications of Medicaid Status

We explored alternative Medicaid status measures in addition to the single indicator for one or more months in 1995 enrolled in Medicaid. The alternatives examined included:

1. Fraction of Medicaid-eligible months in 1995. Results from this variable are not presented, because they are very similar to models using the one or more months Medicaid indicator.
2. Ranges of total Medicaid months, including 1-5 months, 6-9 months, and 10-12 months.
3. Fraction of Medicaid-eligible months by subgroup, including QMBs, SLMBs, medically needy, and SSI and other full Medicaid benefit duals.

Table 5-5 compares the PIPDCG model with different prospective Medicaid status indicators added. Model (1) includes a single one or more months Medicaid indicator, with a coefficient of $2,011. Model (2) includes three ranges of Medicaid months. The coefficients of the different ranges are not very different from each other, indicating little advantage to measuring Medicaid status by number of months eligible in the base year rather than simply eligible for one or more months. Model (3) breaks out the Medicaid subgroups. Although some differences among the groups exist, they are not very large, especially between the SSI and QMB groups, which account for over 90 percent of dual eligibles[6]. Models (4) and (5) allow the Medicaid coefficients to differ by elderly versus disabled. Because of small sample sizes of SLMBs, they are combined with QMBs in Model (5). The

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[6] It is possible that the true expenditure differences among subgroups are larger, but that they are masked by inaccuracies in state reporting of basis of Medicaid eligibility (see Chapter 2).

elderly are more expensive among the SSI group, and the elderly SSI group is nearly as expensive as the medically needy group.

In addition, we explored concurrent Medicaid status versus prospective Medicaid status. Table 5-6 presents the same set of models as those in Table 5-5, except that Medicaid status is defined as of the prediction year - 1996. Based on the models with a single Medicaid indicator (Models (1) and (4) in Table 5-6), the concurrent measures are associated with about $400 - $600 more in payments, and raise explanatory power measured by the R-square by about 0.1 percentage points. Payment differences among subgroups are even smaller than prospectively, with the exception of the medically needy group, which is substantially more expensive concurrently. This is not surprising since medically needy status is associated with high current medical expenditures. Also, individuals with fewer Medicaid months (Model (2)) are associated with much higher payments concurrently than prospectively. This is presumably because individuals with fewer Medicaid months are often new Medicaid eligibles who recently spent down their incomes due to serious health problems. The QMB and SLMB coefficients may be somewhat higher concurrently than prospectively for similar reasons, that is, Medicare beneficiaries with current health problems may be more likely to enroll in Medicaid under QMB/SLMB status. SSI status is determined by poverty, not current health problems, and the prospective and concurrent SSI coefficients (compare Models (3) and (5) in Tables 5-5 and 5-6) are quite similar. These results indicate that concurrent Medicaid status is partially measuring acute, prediction year health care

costs/events, while prospective status is more of a proxy for poverty and longer-run health status.

5.5 Recommendations Concerning Ever Disabled and Medicaid Status

Medicare expenditures for beneficiaries who are ever disabled or Medicaid enrolled are substantially higher than predicted by age, sex, and principal hospital diagnoses. Pricing these important subgroups correctly on average requires adding additional demographic factors to the base PIPDCG model. Including an ever disabled factor avoids payment reductions to health plans as under-age-65 disabled individuals 'age in' to elderly entitlement status. Ever disabled and Medicaid status are relatively immune to manipulation by health plans[7], and are routinely and accurately available in HCFA administrative files. They are good candidates for additional demographic risk adjusters.

They do have some disadvantages. Medicaid eligibility rules vary widely across states, resulting in divergent percentages of the poor enrolled in Medicaid programs. Thus, Medicaid enrollment is an imperfect indicator of the poverty status of individuals. The non-Medicaid poor may also incur higher Medicare expenditures, but it was impossible to examine them with our data. Also, it is not entirely clear what Medicaid status is proxying for. Is it related to the unmeasured health or functional status of individuals, or possibly to inefficient use of the health care system? Although Medicare is a national program not subject to state variation, the criteria to qualify for Medicare disability entitlement may

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[7] Plans could attempt to Medicaid-enroll as many of their Medicare enrollees as possible to obtain higher Medicare capitation payments. This is not necessarily bad.

fluctuate somewhat over time, and applications for disability status may be related to factors such as the strength of the economy. Although not as "exogenous" as age and sex, Medicaid and ever disabled status are reasonable demographic risk adjusters and we recommend that they be added to the PIPDCG model.

We favor a uniform, prospective Medicaid factor for all Medicare beneficiaries with at least one month of Medicaid enrollment in the base year to be used for risk adjustment, except that the factor is allowed to differ by age/sex cell. We favor a prospective rather than concurrent adjustment because a concurrent adjustment appears to be partially measuring acute health care costs/events in the prediction year. This is not consistent with a prospective risk adjustment framework, which is intended to predict future expenses, not pay for higher acute care costs in the prediction year. A concurrent adjustment could make sense if there were substitutions between Medicare- and Medicaid-reimbursed health care. In this case, the currently Medicaid enrolled would have lower Medicare expenses. A concurrent adjuster would account for this substitution, as the 'working aged' adjustment (see Chapter 6) accounts for the primary coverage of working Medicare beneficiaries under private group health insurance. But our empirical estimates show that Medicaid enrollment is associated with *higher* current and future Medicare expenditures. Thus, Medicaid status appears to be proxying for individual characteristics (poverty), and not Medicare/Medicaid substitutions.[8]

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[8] It is possible that Medicaid enrollment raises Medicare expenditures rather than substitutes for them. For example, Medicaid pays Medicare cost sharing, lowering the out of pocket cost of Medicare services. Also, Medicaid covers health care and other (e.g., transportation to providers) services that may be complementary to Medicare services, and thus raises the use of Medicare services. More research is needed on Medicare/Medicaid interactions.

We do not recommend any payment differences by Medicaid eligibility subgroup. The medically needy appear to be more expensive than other dual eligibles, although on a prospective basis the differences among Medicaid subgroups are small. Also, we are concerned about the accuracy and completeness of state reporting of Medicaid eligibility basis to HCFA (see Chapter 2), about the administrative burden on HCFA of verifying subgroup eligibility, and about variations in state program rules. For these reasons, we do not recommend different payment rates for Medicaid subgroups at this time. We do recommend further evaluation of the quality of Medicaid subgroup eligibility reporting to HCFA, and monitoring of Medicare expenditure differences among Medicaid subgroups. We recommend that the Medicaid factor not be differentiated based on number of months of base year Medicaid enrollment because future Medicare expenditures for partial-year enrollees are similar to those for full-year enrollees. We do favor allowing the Medicaid and ever disabled factors to vary by age/sex cell because there are differences in future expenditures, and there are no data quality, gaming or other concerns about doing this. Actuarial smoothing of coefficients/rate cells is required for some age/sex ranges because of small sample sizes and random variation in coefficients.

Table 5-1

Actual and Predicted 1996 Expenditures by Medicaid and Ever Disabled Status

Subgroup	N	Percent of Sample	Mean Actual Payment	Mean Predicted* Expenditure	Predictive Ratio	Difference
Total Sample	1,387,105	100.0%	5,186	5,186	1.00	$0
Never Disabled and Non-Medicaid	1,066,751	76.9	4,015	4,973	1.24	958
Medicaid buyin, total	205,635	14.8	7,332	5,683	0.78	-1,649
QMB	70,493	5.1	7,471	5,923	0.79	-1,547
AGE<65	22,663	1.6	5,789	4,866	0.84	-924
AGE=65+	47,830	3.4	8,309	6,451	0.78	-1,859
SLMB	9,356	0.7	7,808	6,297	0.81	-1,511
AGE<65	2,393	0.2	6,480	5,424	0.84	-1,056
AGE=65+	6,963	0.5	8,286	6,611	0.80	-1,675
Medically Needy	14,578	1.1	8,770	6,688	0.76	-2,081
AGE<65	3,424	0.2	6,894	5,131	0.74	-1,763
AGE=65+	11,154	0.8	9,404	7,215	0.77	-2,189
SSI & Other	117,427	8.5	7,083	5,410	0.76	-1,673
AGE<65	41,030	3.0	5,334	4,577	0.86	-757
AGE=65+	76,397	5.5	8,051	5,871	0.73	-2,179
Ever Disabled, total	87,154	6.3	7,966	5,568	0.70	-2,398
Ever Disabled and Medicaid	21,751	1.6	9,882	5,907	0.60	-3,975

*The predicted expenditure is based on the base PIPDCG model (Model 3 from Table 4-4), including age, sex and diagnoses.

OUTPUT: DIAG74C.al, NEW074C.OUT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 5-2

Demographic and PIPDCG Models With Medicaid and Ever Disabled

Model:	**1**		**2**		**3**		**4 = BASE**	
	AGESEX		**Demographic Model With Full Interactions of Medicaid & Ever Disabled With AGESEX**		**PIPDCG Model With Medicaid/Ever Disabled Interaction**		**PIPDCG Model With Full Interactions of Medicaid & Ever Disabled With AGESEX**	
Number of Observations:	1,387,105		1,387,105		1,387,105		1,387,105	
R-Squared:	0.008679		0.014852		0.062202		0.062644	
Dependent Variable Mean:	5,186		5,186		5,186		5,186	
Root Mean Square Error:	13,946		13,894		13,564		13,563	
Model Parameters	24		59		43		74	
Computer Output.	DIAG99G NEW		DIAG99G NW2		DIAG112E NEW		DIAG112B NW2	
Variable	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**
DEMOGRAPHIC FACTORS:								
EVERDISM	--	--	--	--	2,292	41.29	--	--
MCD95*DISABLEM	--	--	--	--	1,674	22.37	--	--
MCD95*ELDERLYM	--	--	--	--	2,109	48.33	--	--
EVERDISM*MCD95	--	--	--	--	9	0.08	--	--
DEMOGRAPHIC INTERACTIONS:								
MALE. 0-34*Medicaid	--	--	1,120	3.89	--	--	592	2.10
MALE. 35-44*Medicaid	--	--	1,983	10.30	--	--	1,489	7.93
MALE. 45-54*Medicaid	--	--	2,381	12.49	--	--	1,854	9.96
MALE: 55-59*Medicaid	--	--	2,560	9.05	--	--	1,986	7.19
MALE: 60-64*Medicaid	--	--	2,578	9.42	--	--	1,827	6.84
MALE: 65-69*Medicaid	--	--	3,037	18.11	--	--	2,255	13.77
MALE: 70-74*Medicaid	--	--	2,948	18.45	--	--	2,325	14.90
MALE. 75-79*Medicaid	--	--	3,111	16.50	--	--	2,383	12.95
MALE: 80-84*Medicaid	--	--	3,067	13.97	--	--	2,236	10.43
MALE: 85-89*Medicaid	--	--	3,104	11.16	--	--	2,231	8.22
MALE: 90-94*Medicaid	--	--	1,910	4.63	--	--	1,363	3.39
MALE: 95+*Medicaid	--	--	1,801	2.46	--	--	1,508	2.11
FEMALE: 0-34*Medicaid	--	--	1,313	3.48	--	--	881	2.39
FEMALE: 35-44*Medicaid	--	--	2,175	8.67	--	--	1,739	7.10
FEMALE: 45-54*Medicaid	--	--	2,163	9.86	--	--	1,723	8.05
FEMALE: 55-59*Medicaid	--	--	2,809	9.84	--	--	2,210	7.93
FEMALE: 60-64*Medicaid	--	--	2,286	9.07	--	--	1,875	7.62
FEMALE: 65-69*Medicaid	--	--	3,100	24.84	--	--	2,384	19.56
FEMALE: 70-74*Medicaid	--	--	2,909	27.76	--	--	2,146	20.97
FEMALE: 75-79*Medicaid	--	--	3,000	26.91	--	--	2,341	21.50
FEMALE: 80-84*Medicaid	--	--	2,989	25.22	--	--	2,266	19.58
FEMALE: 85-89*Medicaid	--	--	2,136	15.65	--	--	1,520	11.41
FEMALE. 90-94*Medicaid	--	--	1,663	8.99	--	--	1,252	6.93
FEMALE: 95+*Medicaid	--	--	885	3.10	--	--	497	1.79
MALE: 65-69*Ever-disabled	--	--	2,860	23.37	--	--	2,119	17.72
MALE: 70-74*Ever-disabled	--	--	2,723	21.07	--	--	2,042	16.18
MALE: 75-79*Ever-disabled	--	--	2,248	14.23	--	--	1,678	10.89
MALE: 80-84*Ever-disabled	--	--	1,968	8.85	--	--	1,464	6.74
MALE: 85-89*Ever-disabled	--	--	982	2.07	--	--	332	0.72
MALE: 90-94*Ever-disabled	--	--	-8,538	-0.61	--	--	-6,993	-0.52
MALE: 95+*Ever-disabled	--	--	--	--	--	--	--	--
FEMALE: 65-69*Ever-disabled	--	--	3,794	27.09	--	--	2,994	21.88
FEMALE. 70-74*Ever-disabled	--	--	3,611	25.31	--	--	2,971	21.32
FEMALE 75-79*Ever-disabled	--	--	3,320	21.11	--	--	2,630	17.13
FEMALE. 80-84*Ever-disabled	--	--	2,359	12.16	--	--	1,799	9.50
FEMALE: 85-89*Ever-disabled	--	--	2,367	5.77	--	--	1,731	4.32
FEMALE 90-94*Ever-disabled	--	--	--	--	--	--	--	--
FEMALE. 95+*Ever-disabled	--	--	--	--	--	--	--	--

Table 5-2 (continued)

Demographic and PIPDCG Models With Medicaid and Ever Disabled

Model:	1		2		3		4 = BASE	
	AGESEX		Demographic Model With Full Interactions of Medicaid & Ever Disabled With AGESEX		PIPDCG Model With Medicaid/Ever Disabled Interaction		PIPDCG Model With Full Interactions of Medicaid & Ever Disabled With AGESEX	
Variable	beta	t-ratio	beta	t-ratio	beta	t-ratio	beta	t-ratio
AGE/SEX GROUPS:								
MALE: 0-34	3,398	25.71	2,604	10.78	1,090	7.84	1,852	7.85
MALE: 35-44	3,893	40.38	2,841	20.30	1,810	17.74	1,907	13.95
MALE: 45-54	4,081	45.42	3,303	30.26	2,517	27.71	2,458	23.05
MALE: 55-59	4,777	38.51	4,121	28.75	3,182	26.03	3,099	22.13
MALE: 60-64	5,496	50.00	4,985	40.70	3,822	35.37	3,878	32.41
MALE: 65-69	3,989	92.59	3,342	70.50	2,703	63.07	2,749	59.25
MALE: 70-74	4,762	124.57	4,320	105.53	3,552	94.08	3,563	88.73
MALE: 75-79	5,934	134.24	5,560	118.15	4,555	104.69	4,592	99.47
MALE: 80-84	7,041	125.91	6,692	112.86	5,413	98.72	5,462	93.93
MALE: 85-89	8,115	98.49	7,783	89.16	6,334	78.68	6,382	74.69
MALE: 90-94	8,813	60.68	8,538	54.59	6,888	48.65	6,993	45.74
MALE: 95+	8,862	30.32	8,503	26.16	6,787	23.85	6,907	21.76
FEMALE: 0-34	3,685	21.88	2,723	8.45	1,252	7.25	1,831	5.82
FEMALE: 35-44	4,211	33.91	2,943	15.37	2,066	16.08	2,028	10.84
FEMALE: 45-54	4,598	41.78	3,545	23.15	2,679	23.69	2,656	17.77
FEMALE: 55-59	5,464	38.48	4,246	22.58	3,473	24.47	3,237	17.63
FEMALE: 60-64	6,707	54.24	5,790	36.58	4,556	36.76	4,563	29.51
FEMALE: 65-69	3,481	89.87	2,791	66.49	2,383	62.32	2,309	56.26
FEMALE: 70-74	4,117	125.18	3,583	101.38	3,021	92.89	2,978	86.02
FEMALE: 75-79	5,141	143.35	4,599	118.92	3,832	107.98	3,786	99.80
FEMALE: 80-84	6,226	150.49	5,681	125.95	4,660	113.69	4,662	105.25
FEMALE: 85-89	7,241	136.57	6,807	115.92	5,454	103.92	5,572	96.69
FEMALE: 90-94	7,720	97.30	7,321	80.71	5,701	72.93	5,907	66.50
FEMALE: 95+	7,323	54.40	7,026	42.89	5,206	39.48	5,741	35.87
PIPDCGs[†]:								
5	--	--	--	--	1,708	5.66	1,722	5.71
6	--	--	--	--	2,290	7.02	2,276	6.98
7	--	--	--	--	3,431	10.71	3,418	10.67
8	--	--	--	--	4,073	49.12	4,070	49.08
9	--	--	--	--	4,639	48.33	4,635	48.30
10	--	--	--	--	5,845	51.51	5,842	51.49
11	--	--	--	--	6,410	66.24	6,407	66.22
12	--	--	--	--	8,405	98.12	8,396	98.02
14	--	--	--	--	10,145	60.30	10,146	60.30
16	--	--	--	--	12,280	146.49	12,279	146.49
18	--	--	--	--	13,540	70.73	13,538	70.72
20	--	--	--	--	17,149	90.17	17,155	90.21
23	--	--	--	--	19,392	87.33	19,383	87.30
26	--	--	--	--	22,287	60.78	22,274	60.75
29	--	--	--	--	26,050	65.24	26,070	65.29

[†] PIPDCG 4 is the omitted category

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 5-3

Rate Cell Factors for Base PIPDCG Model (Short Stays Included)*

		(1) Never Disabled, Non-Medicaid	(2) Ever Disabled, Non-Medicaid	(3) Medicaid, Never Disabled	(4) Medicaid and Ever Disabled
I. Demographic Factor (one per person)					
MALE	0-34	n/a	0.36	n/a	0.47
	35-44	n/a	0.37	n/a	0.65
	45-54	n/a	0.47	n/a	0.83
	55-59	n/a	0.60	n/a	0.98
	60-64	n/a	0.75	n/a	1.10
	65-69	0.53	0.94	0.96	1.37
	70-74	0.69	1.08	1.14	1.53
	75-79	0.89	1.21	1.35	1.67
	80-84	1.05	1.34	1.48	1.77
	85-89	1.23	1.29	1.66	1.72
	90-94	1.35	1.41	1.61	1.68
	95+	1.33	1.40	1.62	1.69
FEMALE	0-34	n/a	0.35	n/a	0.52
	35-44	n/a	0.39	n/a	0.73
	45-54	n/a	0.51	n/a	0.84
	55-59	n/a	0.62	n/a	1.05
	60-64	n/a	0.88	n/a	1.24
	65-69	0.45	1.02	0.90	1.48
	70-74	0.57	1.15	0.99	1.56
	75-79	0.73	1.24	1.18	1.69
	80-84	0.90	1.25	1.34	1.68
	85-89	1.07	1.41	1.37	1.70
	90-94	1.14	1.47	1.38	1.71
	95+	1.11	1.44	1.20	1.54
II. PIPDCG Factor (one per person -- add to demographic factor)					
PIPDCGs	4	0.00			
	5	0.33			
	6	0.44			
	7	0.66			
	8	0.78			
	9	0.89			
	10	1.13			
	11	1.24			
	12	1.62			
	14	1.96			
	16	2.37			
	18	2.61			
	20	3.31			
	23	3.74			
	26	4.30			
	29	5.03			

* Model (4) of Table 5-2. Preliminary, subject to actuarial smoothing of coefficients.

NOTES:

Rate cell denominator: overall Sample Mean, $5,186.
Ever-disabled coefficients for male and female 90-94, 95+ were set to value for age 85-89.
N/A = not applicable.

Computer Output: Diag112B.NW2

SOURCE: Health Economics Research, Inc. Analysis of 1995, 1996 Medicare data.

Table 5-4

1999 AAPCC Demographic Cost Factors for the Aged

Part	Sex	Age	Institutional	Non-Institutional		
				Medicaid	Non-Medicaid	Working Aged
A	Male	65 - 69	1.75	1.15	0.65	0.40
		70 - 74	2.25	1.50	0.85	0.45
		75 - 79	2.25	1.95	1.05	0.70
		80 - 84	2.25	2.35	1.20	0.80
		85 & Over	2.25	2.60	1.35	0.90
	Female	65 - 69	1.45	0.80	0.55	0.35
		70 - 74	1.80	1.05	0.70	0.45
		75 - 79	2.10	1.45	0.85	0.55
		80 - 84	2.10	1.70	1.05	0.70
		85 & Over	2.10	2.10	1.20	0.80
B	Male	65 - 69	1.60	1.10	0.80	0.45
		70 - 74	1.80	1.35	0.95	0.65
		75 - 79	1.95	1.55	1.10	0.80
		80 - 84	1.95	1.70	1.15	0.90
		85 & Over	1.95	1.70	1.15	1.00
	Female	65 - 69	1.50	1.05	0.70	0.40
		70 - 74	1.65	1.15	0.85	0.55
		75 - 79	1.65	1.25	0.95	0.70
		80 - 84	1.65	1.25	0.95	0.75
		85 & Over	1.65	1.25	1.00	0.85

SOURCE: Public use file maintained on HCFA's website.

Table 5-5

PIPDCG Models With Prospective Medicaid Status*

Model:	1		2		3		4		5	
	One or More Months Medicaid Indicator		Ranges of Medicaid Months		Medicaid Subgroup		Medicaid Indicator + Elderly/ Disabled Interaction		Medicaid Subgroup + Elderly/ Disabled Interaction	
Number of Observations:	1,387,105		1,387,105		1,387,105		1,387,105		1,387,105	
R-Squared:	0.062184		0.062193		0.062155		0.062202		0.062188	
Dependent Variable Mean:	5,186		5,186		5,186		5,186		5,186	
Root Mean Square Error:	13,564		13,564		13,565		13,564		13,564	
Model Parameters:	41		43		44		42		45	
Computer Output:	NEW080F.OUT		NEW080F.OUT		NEW080F.OUT		NEW080F.OUT		NEW080F.OUT	
Variable	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**
DEMOGRAPHIC FACTORS:										
Ever Disabled	2,311	47.27	2,309	47.23	2,317	47.40	2,294	46.82	2,302	46.98
Medicaid	2,011	56.51	--	--	--	--	--	--	--	--
Medicaid 1-5 months	--	--	1,617	11.34	--	--	--	--	--	--
Medicaid 6-9 months	--	--	1,717	11.81	--	--	--	--	--	--
Medicaid 10-12 months	--	--	2,046	55.46	--	--	--	--	--	--
Medicaid * Elderly	--	--	--	--	--	--	2,110	52.11	--	--
Medicaid * Disabled	--	--	--	--	--	--	1,674	22.38	--	--
QMB	--	--	--	--	1,905	32.04	--	--	--	--
SLMB	--	--	--	--	1,715	10.04	--	--	--	--
(QMB+SLMB)*Elderly	--	--	--	--	--	--	--	--	1,888	28.19
(QMB+SLMB)*Disabled	--	--	--	--	--	--	--	--	1,743	16.05
Medically Needy	--	--	--	--	2,529	18.89	--	--	2,498	18.65
SSI	--	--	--	--	2,115	46.25	--	--	--	--
SSI*Elderly	--	--	--	--	--	--	--	--	2,314	43.05
SSI*Disabled	--	--	--	--	--	--	--	--	1,581	17.84

Table 5-5 (continued)

PIPDCG Models With Prospective Medicaid Status*

Model:	1		2		3		4		5	
	One or More Months Medicaid Indicator		Ranges of Medicaid Months		Medicaid Subgroup		Medicaid Indicator + Elderly/ Disabled Interaction		Medicaid Subgroup + Elderly/ Disabled Interaction	
Variable	beta	t-ratio	beta	t-ratio	beta	t-ratio	beta	t-ratio	beta	t-ratio
AGE/SEX GROUPS:										
MALE: 0-34	852	6.50	849	6.47	875	6.67	1,090	7.84	1,155	8.35
MALE: 35-44	1,631	17.01	1,632	17.01	1,668	17.40	1,810	17.74	1,854	18.34
MALE: 45-54	2,407	27.27	2,407	27.28	2,432	27.57	2,517	27.71	2,539	28.10
MALE: 55-59	3,096	25.57	3,096	25.57	3,115	25.73	3,182	26.03	3,198	26.20
MALE: 60-64	3,755	35.00	3,756	35.01	3,772	35.17	3,822	35.37	3,836	35.54
MALE: 65-69	2,707	63.26	2,708	63.28	2,712	63.37	2,702	63.14	2,706	63.23
MALE: 70-74	3,557	94.32	3,556	94.32	3,558	94.35	3,552	94.19	3,552	94.18
MALE: 75-79	4,559	104.89	4,558	104.89	4,560	104.92	4,554	104.78	4,555	104.80
MALE: 80-84	5,418	98.87	5,419	98.87	5,421	98.91	5,413	98.75	5,415	98.80
MALE: 85-89	6,342	78.82	6,343	78.82	6,346	78.87	6,333	78.69	6,338	78.75
MALE: 90-94	6,901	48.76	6,901	48.76	6,906	48.79	6,888	48.65	6,893	48.69
MALE: 95+	6,806	23.92	6,805	23.92	6,811	23.94	6,786	23.85	6,793	23.88
FEMALE: 0-34	1,006	6.06	1,001	6.03	1,025	6.17	1,252	7.25	1,316	7.64
FEMALE: 35-44	1,869	15.24	1,866	15.21	1,896	15.46	2,066	16.08	2,110	16.51
FEMALE: 45-54	2,515	23.19	2,513	23.16	2,540	23.42	2,679	23.69	2,715	24.13
FEMALE: 55-59	3,326	23.93	3,324	23.90	3,347	24.08	3,473	24.47	3,506	24.76
FEMALE: 60-64	4,423	36.50	4,420	36.47	4,443	36.66	4,556	36.76	4,582	37.07
FEMALE: 65-69	2,393	62.65	2,392	62.64	2,397	62.77	2,383	62.32	2,385	62.36
FEMALE: 70-74	3,031	93.43	3,030	93.40	3,035	93.54	3,021	92.95	3,022	92.97
FEMALE: 75-79	3,843	108.54	3,842	108.51	3,847	108.66	3,832	108.05	3,835	108.14
FEMALE: 80-84	4,673	114.32	4,673	114.30	4,679	114.47	4,660	113.77	4,666	113.95
FEMALE: 85-89	5,472	104.61	5,472	104.61	5,483	104.82	5,454	104.04	5,468	104.34
FEMALE: 90-94	5,725	73.44	5,725	73.45	5,741	73.63	5,701	73.02	5,723	73.30
FEMALE: 95+	5,238	39.80	5,238	39.80	5,259	39.93	5,206	39.51	5,237	39.73

Table 5-5 (continued)

PIPDCG Models With Prospective Medicaid Status*

Model:	1		2		3		4		5	
	One or More Months Medicaid Indicator		Ranges of Medicaid Months		Medicaid Subgroup		Medicaid Indicator + Elderly/ Disabled Interaction		Medicaid Subgroup + Elderly/ Disabled Interaction	
PIPDCGs†:										
5	1,705	5.65	1,705	5.65	1,704	5.65	1,708	5.66	1,711	5.67
6	2,291	7.03	2,293	7.03	2,300	7.05	2,290	7.02	2,300	7.05
7	3,424	10.69	3,431	10.71	3,451	10.77	3,431	10.71	3,462	10.80
8	4,073	49.11	4,075	49.14	4,081	49.21	4,073	49.12	4,081	49.21
9	4,640	48.34	4,645	48.39	4,658	48.53	4,639	48.33	4,658	48.53
10	5,836	51.44	5,841	51.48	5,857	51.63	5,845	51.51	5,865	51.69
11	6,413	66.27	6,415	66.29	6,427	66.42	6,410	66.24	6,425	66.40
12	8,406	98.13	8,415	98.19	8,444	98.59	8,405	98.12	8,443	98.59
14	10,146	60.30	10,153	60.34	10,174	60.46	10,145	60.30	10,174	60.46
16	12,284	146.55	12,288	146.58	12,303	146.78	12,280	146.49	12,298	146.72
18	13,545	70.76	13,550	70.78	13,565	70.86	13,540	70.73	13,561	70.84
20	17,156	90.21	17,162	90.24	17,187	90.38	17,149	90.17	17,182	90.34
23	19,396	87.35	19,402	87.38	19,424	87.48	19,392	87.33	19,417	87.45
26	22,287	60.78	22,292	60.79	22,303	60.82	22,287	60.78	22,303	60.82
29	26,032	65.20	26,036	65.21	26,052	65.25	26,050	65.24	26,072	65.30

†PIPDCG 4 is the omitted category.

*Mediciad status is defined as of the base year, 1995.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 5-6

PIPDCG Models With Concurrent Medicaid Status*

Model:	1		2		3		4		5	
	One or More Months Medicaid Indicator		Ranges of Medicaid Months		Medicaid Subgroup		Medicaid Indicator + Elderly/ Disabled Interaction		Medicaid Subgroup + Elderly/ Disabled Interaction	
Number of Observations:	1,387,105		1,387,105		1,387,105		1,387,105		1,387,105	
R-Squared:	0.063623		0.069575		0.063015		0.063659		0.063037	
Dependent Variable Mean:	5,186		5,186		5,186		5,186		5,186	
Root Mean Square Error:	13,554		13,511		13,558		13,554		13,558	
Model Parameters:	41		43		44		42		45	
Computer Output:	NEW080F.OUT		NEW080F.OUT		NEW080F.OUT		NEW080F.OUT		NEW080F.OUT	
Variable	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**
DEMOGRAPHIC FACTORS:										
Ever Disabled	2,210	45.25	2,247	46.13	2,254	46.12	2,187	44.66	2,239	45.72
Medicaid	2,543	73.00	--	--	--	--	--	--	--	--
Medicaid 1-5 months	--	--	11,723	88.32	--	--	--	--	--	--
Medicaid 6-9 months	--	--	9,689	74.54	--	--	--	--	--	--
Medicaid 10-12 months	--	--	1,571	43.33	--	--	--	--	--	--
Medicaid * Elderly	--	--	--	--	--	--	2,679	67.95	--	--
Medicaid * Disabled	--	--	--	--	--	--	2,059	27.60	--	--
QMB	--	--	--	--	2,314	40.61	--	--	--	--
SLMB	--	--	--	--	2,316	16.07	--	--	--	--
(QMB+SLMB)*Elderly	--	--	--	--	--	--	--	--	2,361	37.63
(QMB+SLMB)*Disabled	--	--	--	--	--	--	--	--	2,080	19.76
Medically Needy	--	--	--	--	3,533	28.63	--	--	3,512	28.45
SSI	--	--	--	--	2,243	49.48	--	--	--	--
SSI*Elderly	--	--	--	--	--	--	--	--	2,389	45.01
SSI*Disabled	--	--	--	--	--	--	--	--	1,816	20.47

Table 5-6 (continued)

PIPDCG Models With Concurrent Medicaid Status*

Model:	1		2		3		4		5	
	One or More Months Medicaid Indicator		Ranges of Medicaid Months		Medicaid Subgroup		Medicaid Indicator + Elderly/ Disabled Interaction		Medicaid Subgroup + Elderly/ Disabled Interaction	
Variable	beta	t-ratio	beta	t-ratio	beta	t-ratio	beta	t-ratio	beta	t-ratio
AGE/SEX GROUPS:										
MALE: 0-34	491	3.75	650	4.98	731	5.58	831	5.99	972	7.04
MALE: 35-44	1,358	14.18	1,477	15.47	1,527	15.95	1,614	15.84	1,697	16.79
MALE: 45-54	2,232	25.32	2,292	26.08	2,332	26.45	2,392	26.34	2,433	26.92
MALE: 55-59	2,949	24.38	2,970	24.63	3,032	25.06	3,077	25.18	3,112	25.50
MALE: 60-64	3,641	33.97	3,650	34.16	3,702	34.53	3,741	34.63	3,764	34.88
MALE: 65-69	2,680	62.68	2,677	62.80	2,697	63.06	2,674	62.52	2,692	62.93
MALE: 70-74	3,531	93.71	3,534	94.10	3,545	94.04	3,525	93.52	3,540	93.90
MALE: 75-79	4,531	104.35	4,521	104.44	4,544	104.59	4,525	104.19	4,539	104.48
MALE: 80-84	5,379	98.22	5,355	98.09	5,394	98.46	5,370	98.04	5,388	98.35
MALE: 85-89	6,271	77.98	6,198	77.32	6,297	78.28	6,257	77.79	6,289	78.17
MALE: 90-94	6,796	48.05	6,688	47.43	6,829	48.27	6,775	47.89	6,817	48.17
MALE: 95+	6,652	23.40	6,446	22.75	6,700	23.56	6,623	23.29	6,683	23.50
FEMALE: 0-34	630	3.80	918	5.56	860	5.18	983	5.70	1,112	6.46
FEMALE: 35-44	1,559	12.73	1,766	14.46	1,744	14.24	1,843	14.35	1,938	15.17
FEMALE: 45-54	2,254	20.80	2,436	22.54	2,403	22.17	2,492	22.03	2,563	22.77
FEMALE: 55-59	3,088	22.23	3,246	23.44	3,223	23.20	3,302	23.26	3,369	23.78
FEMALE: 60-64	4,202	34.69	4,336	35.92	4,325	35.70	4,396	35.46	4,454	36.02
FEMALE: 65-69	2,334	61.15	2,364	62.12	2,367	62.00	2,320	60.72	2,357	61.64
FEMALE: 70-74	2,968	91.54	3,000	92.82	3,002	92.55	2,953	90.92	2,991	92.03
FEMALE: 75-79	3,774	106.65	3,800	107.71	3,807	107.57	3,759	106.02	3,796	107.08
FEMALE: 80-84	4,581	112.08	4,576	112.29	4,621	113.03	4,562	111.37	4,608	112.51
FEMALE: 85-89	5,341	102.08	5,293	101.49	5,388	102.96	5,314	101.33	5,373	102.47
FEMALE: 90-94	5,543	71.11	5,429	69.86	5,598	71.76	5,508	70.52	5,580	71.41
FEMALE: 95+	5,007	38.06	4,826	36.79	5,067	38.48	4,959	37.65	5,044	38.26

Table 5-6 (continued)

PIPDCG Models With Concurrent Medicaid Status*

Model:	1		2		3		4		5	
	One or More Months Medicaid Indicator		Ranges of Medicaid Months		Medicaid Subgroup		Medicaid Indicator + Elderly/ Disabled Interaction		Medicaid Subgroup + Elderly/ Disabled Interaction	
Variable	beta	t-ratio	beta	t-ratio	beta	t-ratio	beta	t-ratio	beta	t-ratio
PIPDCGs†:										
5	1,704	5.65	1,686	5.61	1,703	5.65	1,709	5.67	1,707	5.66
6	2,285	7.01	2,242	6.90	2,284	7.01	2,284	7.01	2,284	7.01
7	3,372	10.53	3,237	10.15	3,421	10.68	3,383	10.57	3,429	10.71
8	4,065	49.06	4,047	48.99	4,072	49.12	4,065	49.06	4,071	49.12
9	4,598	47.94	4,540	47.48	4,608	48.03	4,595	47.91	4,608	48.02
10	5,791	51.08	5,752	50.89	5,822	51.34	5,805	51.19	5,831	51.41
11	6,359	65.76	6,311	65.48	6,377	65.92	6,354	65.72	6,375	65.90
12	8,325	97.24	8,205	96.14	8,354	97.55	8,323	97.22	8,353	97.54
14	10,043	59.73	9,913	59.14	10,066	59.84	10,039	59.71	10,066	59.84
16	12,221	145.89	12,110	145.02	12,249	146.18	12,215	145.81	12,245	146.13
18	13,477	70.46	13,337	69.95	13,499	70.54	13,471	70.43	13,495	70.53
20	17,035	89.64	16,856	88.98	17,060	89.73	17,024	89.58	17,055	89.70
23	19,305	87.00	19,094	86.32	19,334	87.11	19,297	86.97	19,328	87.08
26	22,275	60.79	21,948	60.09	22,269	60.76	22,273	60.79	22,267	60.75
29	25,977	65.11	25,760	64.77	25,982	65.10	26,005	65.18	26,002	65.15

[†] PIPDCG 4 is the omitted category.

*Mediciad status is defined as of the prediction year, 1996.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

6

Working Aged Demographic Factor

In this chapter, we consider a third additional demographic factor for the PIPDCG model, 'working aged'. The next section defines working aged status and identifies the rationale for using it as a payment adjuster. Section 6.2 presents descriptive statistics on Medicare payments for beneficiaries in working aged status. Sections 6.3 through 6.5 contain an analysis of the relationship between actual Medicare payments for working aged beneficiaries and payments predicted by the base PIPDCG model. A multiplicative adjustment is derived that makes predicted payments more consistent with actual payments. Section 6.6 concludes this chapter with recommendations for using working aged status in Medicare risk adjustment. See Chapter 2 for additional details on variable definition and file construction.

6.1 Introduction

'Working aged' indicates aged Medicare beneficiaries (age 65 years or more) with private group health insurance coverage from their or their spouse's employer. By law, Medicare is a secondary payer for these beneficiaries. The primary private health plan must pay for medical expenses to the extent of its defined benefits. Only if Medicare covers services not covered by the private plan, or has more generous coverage (e.g., lower deductibles and copayments) for Medicare-covered services, is Medicare responsible for

payment, and then only to the extent of the difference in coverage. The working aged have lower Medicare expenditures for this reason, and also because working may be a proxy for better health.[1]

'Working aged' is an adjustment factor under HCFA's current AAPCC methodology. Unlike Medicaid status, it is inherently a concurrent (payment year) adjuster, because Medicare expenditures are lower during the period when Medicare is a secondary payer. Given real world data lags, adjusting for working aged status requires retrospective adjustments to Medicare capitation payments.

Individuals with working aged status in either the base (1995) or prediction (1996) year were not included in the PIPDCG model development sample. They were excluded because, since Medicare is a secondary payer, Medicare administrative files do not contain all of their medical claims. A complete base year diagnostic profile cannot be developed, and Medicare expenditures represent only a portion of their total prediction year medical expenses. Therefore, the working aged may give an inaccurate representation of the relationship between diagnoses and expenditures.

Instead, we develop a payment adjustment for working aged status based on a 'second-stage' analysis. Actual Medicare payments for the working aged are related to payments predicted by the base PIPDCG model, including Medicaid and ever disabled status. At the time this report was written, HCFA's preferred base model excluded diagnoses from

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[1] Note that the 'working' aged may not be working, because they include beneficiaries who obtain private health insurance coverage through a working spouse. Throughout this section, we will use the terms 'working' and 'working aged' to include both those who are actually working, and the spouses of those who are working.

hospital stays lasting less than two days. Excluding short stays is discussed in Chapter 8. Since working aged is a payment factor, we use the base PIPDCG model excluding short stays (Table 8-6) to generate 'first-stage' predictions for the working aged analysis. This first stage model is very similar to the base PIPDCG model we have discussed, Model (4) of Table 5-2.

We develop a working aged adjustment factor based on our data from fee-for-service (FFS) Medicare. There is some question about the appropriateness of these data to develop a working aged factor for adjusting payment to HMOs. HMOs typically have comprehensive benefits with low deductibles and copayments. Medicare payments for working aged beneficiaries enrolled in traditional FFS Medicare could be higher than for beneficiaries enrolled in Medicare HMOs, if these beneficiaries are also enrolled in private HMOs (e.g., private employer 'age-ins'). We acknowledge this caveat, but FFS data are the only data currently available to develop the working aged adjustment.

6.2 Descriptive Statistics

We begin, in Table 6-1, with descriptive statistics on the working aged. Overall, in our 5 percent Medicare sample, there are 15,461 beneficiaries with at least one month of working aged status in 1996. This represents 1.1 percent of our total PIPDCG modelling sample plus working aged of 1,406,542 (see Table 2-3). About twice as many of the working aged are male than female, and about half of them are 'young elderly', ages 65 to 69.

As expected, the working aged have much lower than average Medicare expenditures. The overall mean average 1996 payment for the working aged is $1,200, compared to $5,186 for the non-working aged (the PIPDCG modelling sample). To some extent this difference is due to the younger average age of the working aged than the elderly Medicare population as a whole. But average expenditures for non-working-aged males, 65-69 are $4,008 (Table 2-11), compared to $1,079 for working aged males aged 65-69 (Table 6-1).

Medicare expenditures for the working aged rise with age, are higher for males, and increase with base year hospitalization (PIPDCG>4 indicates hospitalization, while PIPDCG=4 indicates no hospitalization, or for excluded diagnoses only). This suggests that Medicare payments for the working aged are correlated with factors included in the PIPDCG model—age, sex, and hospitalization—so that PIPDCG predictions could provide a ‘first stage’ basis for predicting working aged payments. But as Table 6-1 clearly shows, PIPDCG-predicted payments are considerably greater than actual payments, so a downward adjustment to predicted payments must be made.

A simple adjustment to PIPDCG predictions is a ‘multiplier’ that scales predictions to be lower for the working aged. The ratio of actual Medicare payments for the working aged to payments predicted by the base PIPDCG model is 0.30. This ratio is fairly stable across age/sex cells. It tends to be slightly higher at the older ages, for females, and for beneficiaries hospitalized in 1995 (PIPDCG>4).

6.3 Development of a Risk Adjustment Factor

Our goal is to develop a risk adjustment formula for the working aged that predicts their actual Medicare expenditures as accurately as possible. The descriptive statistics suggest that the PIPDCG model can be used to provide 'first-stage' predictions for the working aged. But these first-stage predictions must be reduced to correspond to actual expenditures on the working aged. In Section 6.3.1, we specify a model to analyze the relationship between actual and predicted expenditures. In Section 6.3.2, we discuss estimation of the model, and in Section 6.3.3, we present results.

6.3.1 Model Specification

First stage predicted expenditures can be reduced to correspond to actual expenditures either by adding a negative number (subtraction) or multiplying by a factor less than one, or both. For example, Table 6-1 shows that mean predicted payments for the working aged are $4,003 while mean actual payments are $1,200. Predicted payments, $4,003, can be equated to actual payments, $1,200, by adding –$2,803 or by multiplying by 0.30. Or predicted payments could be multiplied by 0.5 and then -$802 could be added.

We analyzed both additive and multiplicative adjustments to predicted payments for the working aged. A multiplicative adjustment assumes that Medicare expenditures for the working aged, although lower, increase with age and severity of hospital diagnosis in the same proportion as for the non-working-aged. An additive adjustment assumes that actual

expenditures are always lower than predicted expenditures by the same lump sum amount, independent of age, sex, hospitalization, and diagnosis.

We choose an algebraic form to model payments for the working aged that allows both an additive and a multiplicative adjustment. In a month in which a person is in working aged status, we assume that Medicare payment (MP^{WA}) is given by

$$MP^{WA} = (\alpha^{WA} + \beta^{WA} \bullet PE)/12, \tag{6-1}$$

where α^{WA} is an annualized additive (lump sum) payment factor for working aged months,

β^{WA} is a multiplier for working aged months, and

PE is 'first stage' predicted annualized expenditures from the base PIPDCG model.

In months in which a person is not in working aged status, payment (MP^{NWA}) is given by

$$MP^{NWA} = (\alpha^{NWA} + \beta^{NWA} \bullet PE)/12, \tag{6-2}$$

where α^{NWA} is an annualized additive payment factor for non-working aged months, and β^{NWA} is a multiplier for non-working aged months. Note that using this notation, monthly payment for the non-working-aged is simply PE/12, annualized expenditures predicted by the PIPDCG model divided by 12. Payment for the working aged in non-working aged months might differ from this because the working aged are in better health, on average.

Since a person can move from working aged status to non-working-aged status (or vice versa) in a year, we need to adjust for the fraction of the year in the two statuses. Annualized months paid at the working aged rate are

$$WAF = WAM/ELIGMON, \tag{6-3}$$

where WAF = 'working aged fraction',

WAM = months in the payment year in working aged status, and

ELIGMON = months in the payment year alive and eligible for Medicare.

Annualized months paid at the non-working aged rate are (1-WAF). Total annualized payment for a person (PAY) is then

$$PAY = WAF \bullet (\alpha^{WA} + \beta^{WA} \bullet PE) + (1-WAF)*(\alpha^{NWA} + \beta^{NWA} \bullet PE) \tag{6-4}$$

$$= \alpha^{NWA} + (\alpha^{WA}-\alpha^{NWA}) \bullet WAF + \beta^{NWA} \bullet PE + (\beta^{WA}-\beta^{NWA}) \bullet WAF \bullet PE. \tag{6-5}$$

Equation (6-5) is the general specification of simulated payment that we analyzed.

But HCFA's payment system for working aged has the operational constraint that working aged status must be determined separately for each month without reference to other months during the year. This implies that in non-working aged months, the working aged must be paid the same amount as the non-working-aged, i.e., (PE/12). That is, HCFA's payment system imposes the constraints $\alpha^{NWA}=0$ and $\beta^{NWA}=1$. In this case, simulated payment reduces to

$$PAY = \alpha^{WA} \bullet WAF + PE + (\beta^{WA}-1) \bullet WAF \bullet PE. \tag{6-6}$$

A further attractive simplification to investigate is to use a multiplier-only adjustment for working aged status, which implies that the additive adjustment $\alpha^{WA} = 0$. In this case, equation (6-6) reduces to

$$PAY = PE + (\beta^{WA}-1) \bullet WAF \bullet PE. \tag{6-7}$$

We estimated these two special cases—equations (6-6) and (6-7) in addition to the general specification, equation (6-5).

6.3.2 Model Estimation

We used least squares regression to estimate the parameters of the payment formula so that predicted payments (PAY) match actual payments as well as possible. Let ‘AE’ denote actual annualized Medicare expenditures in 1996, and ‘e’ an error term that captures the difference between actual and predicted payments for each working aged beneficiary. Corresponding to the three specifications derived above—equations (6-5), (6-6), and (6-7), we estimated the three regression models shown below to estimate the unknown parameters α^{WA}, α^{NWA}, β^{WA}, and β^{NWA}.

Model 1: Multiplicative and Additive Effects for Working Aged and Non-Working Aged Months

$$AE = \alpha^{NWA} + (\alpha^{WA}-\alpha^{NWA}) \bullet WAF + \beta^{NWA} \bullet PE + (\beta^{WA}-\beta^{NWA}) \bullet WAF \bullet PE + e.$$

Model 2: Multiplicative and Additive Effects for Working Aged Months Only

$$AE = \alpha^{WA} \bullet WAF + PE + (\beta^{WA}-1) \bullet WAF \bullet PE + e,$$

$$\text{or } AE - PE = \alpha^{WA} \bullet WAF + (\beta^{WA}-1) \bullet WAF \bullet PE + e.$$

Model 3: Multiplicative Effect for Working Aged Months Only

$$AE = PE + (\beta^{WA}-1) \bullet WAF \bullet PE + e,$$

$$\text{or } AE - PE = (\beta^{WA}-1) \bullet WAF \bullet PE + e.$$

Note that in Model 2, the additive factor for non-working aged months $\alpha^{NWA}=0$ and the multiplicative factor $\beta^{NWA}=1$, and in Model 3, in addition, the additive factor for working aged months $\alpha^{WA}=0$.

The three models were estimated on a sample restricted to beneficiaries with at least one month of working aged status in 1996 (n=15,461). The working aged sample was analyzed independently because the working aged were excluded from the PIPDCG model development sample used in Chapters 4 and 5.1. If the combined working aged/non-working-aged sample were used to develop a working aged factor, the model might imply an adjustment to the payments of the non-working-aged. It is better to calibrate payments independently on the two samples so that no adjustments to the base PIPDCG model developed in previous chapters are necessary.

6.3.3 Results

Table 6-2 shows the results of estimating the three models specified above. The full model (Model 1) has an R-squared of about 3.1 percent, implying that we are predicting the expenditures of the working aged about half as well as expenditures of the non-working aged using the PIPDCG model (the R-square for the base PIPDCG model estimated on the non-working-aged sample is about 6.3%). Lower predictive power is expected because the incomplete diagnostic profile and expenditures of the working aged introduce more randomness into the relationship between predictive factors and expenditures. Still, the

model has much greater predictive power than chance, or demographics alone (not shown in the table).

Model 1 indicates that the monthly payment formula that best approximates actual expenditures for working aged months is given by

–448/12 + 0.35 • (base PIPDCG predicted expenditures)/12.

For non-working-aged months, the best fit is given by

792/12 + 0.63 • (base PIPDCG predicted expenditures)/12.

For example, a 67 year old male, non-Medicaid, never disabled, and with no prior year hospitalizations, is predicted by the base PIPDCG model excluding short stays (Table 8-x) to cost $2,759 in 1996. If he were in working aged status for all of his Medicare-eligible months in 1996, his annualized payment would be 0.35•(2759)-448=$518. This is 518/2759=19 percent of his payment if he were not working aged.

In Model 2 α^{NWA} is constrained to be zero, and β^{NWA} is constrained to be 1, as is operationally required by HCFA's payment system. That is, beneficiaries with a mixture of working aged and non-working aged status in 1996 are constrained to be paid the standard, non-working aged amount in non-working aged months (PE/12). The best linear fit for the working aged months is

-406/12 + 0.33 • • (base PIPDCG predicted expenditures)/12.

This is quite similar to the estimates from Model 1 where α^{NWA} and β^{NWA} are unconstrained.

Model 3 further restricts Model 2 by constraining the additive effect α^{WA} to be zero for the working aged months. This is the pure multiplicative model, where payment for the working aged is determined by base the PIPDCG prediction multiplied by a 'working aged multiplier'. Model 3 estimates that this multiplier is 0.26, so the monthly payment formula for working aged months is

$$0.26 \bullet (\text{ base PIPDCG predicted expenditures})/12.$$

Because the negative additive term is constrained to zero, the estimated multiplier falls from 0.33 to 0.26.

6.4 Derivation of Unbiased Working Aged Multiplier

Model 3, as well as Model 2, does not contain an overall constant, or 'intercept' term. This is because α^{NWA} is constrained to be zero, and thus the intercept term drops out of the regression specification equation (6-5). A consequence of estimating a linear regression model without an intercept term is that the estimated regression does not necessarily 'go through the means of the data'. That is, the model may yield a biased prediction, on average, for the actual expenditures of the working aged. This can be seen in the 'predictive ratio' row at the bottom of Table 6-2. The predictive ratio is defined as the ratio of mean predicted expenditures to mean actual expenditures. When the regression contains an intercept term, as Model 1 does, the regression 'goes through the means of the data', and the payment model is unbiased. The predictive ratio for Model 1 is 1.00. But the predictive ratios for Models

2 and 3 are 1.04 and 1.13, respectively, indicating that the models overpredict the average expenditures of the working aged by 4 percent and 13 percent, respectively.

It is desirable that a payment formula for the working aged be unbiased, that is, that it predict expenditures for the working aged correctly on average. This constraint is easily imposed in the pure multiplicative model.[2] In fact, since this model contains only one parameter, it can be derived algebraically. Return to the specification equation for Model 3 from Section 6.3.2 above,

$$AE = PAY = PE + (\beta^{WA}-1) \bullet WAF \bullet PE. \qquad (6\text{-}8)$$

We want to impose the condition that:

mean of actual expenditures AE = mean of predicted expenditures PAY, or

$$\text{mean}(AE) = \text{mean}(PE) + (\beta^{WA}-1)\text{mean}(WAF \bullet PE), \qquad (6\text{-}9)$$

which implies that

$$\beta^{WA} = [\text{mean}(AE)-\text{mean}(PE)]/[\text{mean}(WAF \bullet PE)] + 1. \qquad (6\text{-}10)$$

Inserting the necessary data,

$$\beta^{WA} = [(1199.85 - 4052.98)/3633.94] + 1 = 0.2149.$$[3]

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[2] It is also possible to impose the 'unbiasedness' constraint on Model 2 by using the 'equality of means' condition to algebraically eliminate the additive term, then estimate the multiplicative term using least squares. But this is rather complex, and in our judgment any gain in payment accuracy is not worth the added complexity.

[3] The means of AE, PE, and PE*WAF are from computer output DIAG119P.OUT.

Rounding to two decimal places, we have

$$\beta^{WA} = 0.21.$$

So the payment formula for working aged months with an unbiased multiplier for working aged is:

$$0.21 \cdot (\text{ base PIPDCG predicted expenditure})/12.$$

During non-working aged months, the beneficiary would be paid exactly the same as the non-working aged, that is, (base PIPDCG predicted expenditures)/12.

Note that if there were no beneficiaries with a mixture of working aged and non-working aged months (WAF=1), then the formula for the unbiased working aged multiplier β^{WA} (equation (10)) reduces to

$$\beta^{WA} = [\text{mean(AE)-mean(PE)}]/[\text{mean(PE)}] + 1 = [\text{mean(AE)/mean(PE)}], \qquad (6\text{-}11)$$

which is just the ratio of mean actual to mean predicted expenditures for the working aged. With our data this is

$$\beta^{WA} = [(1199.85/4052.98)] = 0.296.$$[4]

But this is not the correct unbiased factor. It overestimates the unbiased factor of 0.21 by ignoring the partial year working aged status of some beneficiaries.

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[4] This is the same actual/predicted factor shown for overall working aged in the descriptive Table 6-1.

6.5 Working Aged Multiplier for Demographic Model

A demographic model may be useful for predicting the expenditures of beneficiaries for whom a full base year profile of hospital diagnoses is not available, namely, newly eligible Medicare beneficiaries. Model (2) of Table 5-2 is our base demographic model, which contains age, sex, Medicaid status, and ever disabled status. It may be useful to have a working aged multiplier for this model for use in predicting payments of newly eligible beneficiaries who are in working aged status. To derive an unbiased multiplier for the demographic model, we employ equation (10), but use predicted expenditures from the demographic model (Model (2) of Table 5-2), rather than the PIPDCG model (Model (4) of Table 5-2). The result is:

$$\beta^{WA} \text{ (demographic model)} = [(1199.85 - 4225.28)/3803.01] + 1 = 0.2045.$$[5]

Rounding to two decimal places,

$$\beta^{WA} \text{ (demographic model)} = 0.20.$$

Thus, the multiplier for the demographic model, 0.20, is nearly the same as for the PIPDCG model, 0.21.

6.6 Rate Cell Presentation and Comparison to AAPCC

Table 6-3 shows the rate cell factors implied by the working aged multiplier of 0.21 for the base PIPDCG model excluding short stays. The reader is referred to Section 5.3.3 of

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[5] The data are from computer output DIAG119R.OUT.

Chapter 5 for a discussion of the rate cell presentation of the base PIPDCG model. In Table 6-3, we show rate cells only for 'never disabled, non-Medicaid' beneficiaries, i.e., the nonpoor elderly never entitled to Medicare by reason of disability. Few of the working aged are likely to be Medicaid enrollees or previously disabled; the vast majority should be classified into the never disabled, non-Medicaid group.[6] The age groups younger than age 65 are not shown because, of course, a working aged beneficiary must be age 65 years or older. Table 6-3 is derived by applying the multiplier of 0.21 to the base PIPDCG model excluding diagnoses from short hospital stays (see Chapter 8), which differs only slightly from the base model including short stays (Model 4 of Table 5-2) discussed in Chapter 5. Table 6-3 is normalized to the same expenditure mean as Table 5-3, that is, to the mean of $5,186 for the PIPDCG model development sample[7] (i.e., 1.00 in Table 6-3 implied a mean predicted expenditure of $5,186, which is the PIPDCG model development sample average). Therefore, the risk factors in Table 6-3 can be compared to the factors in Table 5-3, and to the AAPCC working aged factors in Table 5-4, subject to the caveats noted in Section 5.3.3.

As shown by Table 6-3, the working aged have much lower relative risk factors than the non-working aged. This is a direct result of the multiplier of 0.21. For example, a 65-69 year old female who was not hospitalized in the prior year has a factor of only 9 percent of the average beneficiary's factor. This compares to a factor of 0.45 (45%) if she was not in

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[6] However, if a working aged beneficiary is in Medicaid or ever disabled status, those factors are used to compute his or her base PIPDCG model factor, and thus affect the final risk adjustment factor. We have not shown rate cells for the additional groups in Table 6-3 for simplicity since they should rarely occur among the working aged.

[7] Not to the mean expenditure ($1,200) of the separate subsample of working aged beneficiaries.

working aged status (Table 5-3). This is also much lower than the current AAPCC factor, which is 0.35 for Part A and 0.40 for Part B (see Table 5-4). Only if the working aged beneficiary has a base year hospitalization with a diagnosis predictive of much higher future costs does his or her factor approach the average. For example, if the 68 year old woman was hospitalized in the previous year with a principal diagnosis of 'metastatic cancer', which places her in PIPDCG 26, she would have a relative risk factor of 0.09 + 0.90 = 0.99, which is nearly average. These relatively low risk factors seem appropriate given that Medicare is the secondary payer for working aged beneficiaries.

6.7 Recommendations on the Working Aged Factor

We recommend that HCFA include an adjustment for working aged status in its capitation payment model. The working aged are much less expensive to Medicare than the non-working aged because, by law, their private group health insurance is the primary payer for their medical care. These lower Medicare-covered expenses should be reflected in Medicare payments to capitated organizations who enroll Medicare beneficiaries in working aged status.

Currently, only fee-for-service data are available to estimate the working aged factor. These data may imperfectly reflect the HMO benefit design and copayments experienced by the working aged enrolled in private and Medicare HMOs. Nevertheless, estimating an adjustment using fee-for-service data moves in the right direction, and is much better than no adjustment at all.

Medicare expenditures for the working aged are correlated with the same factors that predict expenditures for the non-working aged, namely, age, sex, and hospital diagnoses. Thus, an approach that adjusts downward payments predicted by the base PIPDCG model is reasonable. We believe a simple, unbiased multiplicative adjustment is preferable.

We estimate this unbiased multiplier to be 0.21. For months in which a beneficiary is in working aged status, standardized Medicare payments to an HMO on behalf of this beneficiary can be represented as

0.21 • (base annualized PIPDCG predicted expenditure)/12.

For example, the annualized expenditures predicted by the base PIPDCG model excluding short stays for a 69 year old woman with private group health insurance and no base year hospitalizations (and non-Medicaid, non-ever disabled) are $2,310 in 1996 (Table 8-6). An HMO enrolling her would be paid $40.43 per working aged month by Medicare. In non-working aged months, beneficiaries are paid the same amount as the non-working aged, namely,

(base annualized PIPDCG predicted expenditure)/12.[8]

For the woman in our example, this would amount to $192.50.

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[8] Further work could explore differentiating the multiplier by age and sex. Preliminary models we estimated indicated that sex effects are small, but that the multiplier is greater for ages 75 and over than for ages 65-74. However, it is not clear how much accuracy in HMO payment is improved by subdividing the multiplier using fee-for-service data.

Table 6-1

Mean Actual and Predicted Expenditures by Age and Sex for Working Aged

	Overall Working Aged				Working Aged and PIPDCG = 4				Working Aged and PIPDCG > 4			
	N	Actual Mean Payment	Mean Predicted Expenditure	Actual/ Predicted	N	Actual Mean Payment	Mean Predicted Expenditure	Actual/ Predicted	N	Actual Mean Payment	Mean Predicted Expenditure	Actual/ Predicted
Total	15,461	$1,200	$4,053	0.296	14,295	$984	$3,475	0.283	1,166	$4,000	$11,547	0.346
Male, Total	9,769	1,271	4,370	0.291	8,918	1,050	3,713	0.283	851	3,741	11,704	0.320
65-69	4,923	1,079	3,843	0.281	4,497	925	3,181	0.291	426	2,788	11,244	0.248
70-74	3,043	1,267	4,452	0.285	2,782	1,025	3,810	0.269	261	3,974	11,630	0.342
75-79	1,314	1,600	5,318	0.301	1,213	1,256	4,746	0.265	101	6,154	12,894	0.477
80+	489	2,413	6,746	0.358	426	1,977	5,855	0.338	63	5,682	13,437	0.423
Female, Total	5,692	1,078	3,512	0.307	5,377	874	3,081	0.284	315	4,676	11,136	0.420
65-69	2,821	800	3,058	0.262	2,668	617	2,616	0.236	153	4,132	11,079	0.373
70-74	1,847	1,164	3,476	0.335	1,760	1,051	3,160	0.333	87	3,531	10,103	0.350
75-79	730	1,271	4,363	0.291	689	928	3,969	0.234	41	7,064	11,025	0.641
80+	294	2,789	6,091	0.458	260	2,235	5,057	0.442	34	7,165	14,263	0.502

NOTE Expenditures are predicted using the PIPDCG payment model excluding short stays (the model in Table 8-6, Ouput DIAG123C OU2
Persons with PIPDCG >4 were hospitalized in 1995
Persons with PIPDCG=4 were either not hospitalized in 1995 or hospitalized in 1995 for diagnosis excluded from the payment model

OUTPUT DIAG125E OUT, DIAG125A OUT

SOURCE Health Economics Research, Inc analysis of 1995 and 1996 Medicare claims

Table 6-2

Second Stage Working Aged (WA) Regressions

Model	1		2		3	
	Add/Mult Eff for WA/non-WA Months		Add/Mult Eff for WA Months		Mult Eff for WA Months	
Number of Observations	15,461		15,461		15,461	
R-Squared	0.031251		--		--	
Dependent Variable Mean[1]	1,200		-2,853		-2,853	
Root Mean Squared Error	6,480		6,488		6,491	
Model Parameters	4		2		1	
Computer Output	DIAG119L.OUT		DIAG119L.OUT		DIAG119N.OUT	
Variable	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**
Intercept	792	2.12	--	--	--	--
Working aged fraction (WAF)	-1,240	-3.08	-406	-3.87	--	--
PIPDCG Score[2]	0.63	8.63	--	--	--	--
WAF*(PIPDCG Score)	-0.28	-3.52	-0.67	-30.67	-0.74	-62.81
Implied estimates of:[3]						
α^{WA}	-448		-406		0	
α^{NWA}	792		0		0	
β^{WA}	0.35		0.33		0.26	
β^{NWA}	0.63		1.00		1.00	
Predictive Ratio[4]	1.00		1.04		1.13	

NOTES:

[1] In Models 2 and 3, the dependent variable is actual expenditures minus predicted expenditures; thus the mean of the dependent variable is negative.

[2] Predicted expenditures are from the base PIPDCG model with short-stays excluded, from Table 8-6 (computer output DIAG123C.OU2).

[3] Calculated from the regression coefficients according to the model specifications in the text. In Models 2 and 3, α^{NWA} and β^{NWA} are constrained to be 0 and 1, respectively; in Model 3, in addition, a^{WA} is constrained to be 0.

[4] Ratio of mean expenditures for the working aged predicted by the regression to mean actual expenditures.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare data.

Table 6-3

Rate Cell Factors for Working Aged in the Base PIPDCG Model (Short Stays Excluded)*

		Never Disabled, Non-Medicaid
I. Demographic Factor (one per person)		
MALE	65-69	0.11
	70-74	0.15
	75-79	0.19
	80-84	0.22
	85-89	0.26
	90-94	0.28
	95+	0.28
FEMALE	65-69	0.09
	70-74	0.12
	75-79	0.15
	80-84	0.19
	85-89	0.23
	90-94	0.24
	95+	0.23
II. PIPDCG Factor (one per person -- add to demographic factor)		
PIPDCGs	4	0.00
	5	0.08
	6	0.09
	7	0.14
	8	0.17
	9	0.19
	10	0.24
	11	0.26
	12	0.34
	14	0.41
	16	0.50
	18	0.55
	20	0.70
	23	0.79
	26	0.90
	29	1.07

* Regression model from Table 8-6. Preliminary, subject to actuarial smoothing of coefficients

NOTES:
Relative Risk Score denominator: Overall Sample Mean, $5,186
Ever-disabled score for male and female 90-94, 95+ was set to values for age 85-89

Computer Output: DIAG123C.OU2

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare data

7

Institutional Status

Institutional status is one of the demographic factors that Medicare currently uses to risk adjust capitation payments through the Adjusted Average Per Capita Cost (AAPCC) methodology. Institutional status refers to Medicare beneficiaries who are under care or custody in institutions such as nursing homes. For each prior month in a certified institution, a beneficiary is paid at the higher "institution rate cell" amount the following month. Although institutionalized beneficiaries were included in the sample used to estimate Chapter 5's payment models, it is not possible to identify them from Medicare enrollment files. If the Medicare expenditures of institutionalized beneficiaries are not captured by a payment model's risk factors, predicted expenditures will not equal actual expenditures for the institutionalized. In this chapter, we examine how well the base payment model (Model 4 in Table 5-2) predicts Medicare expenditures for the institutionalized. Also, we present estimates of the effect of institutionalization on Medicare expenditures from a survey of beneficiaries that identifies the institutionalized.

The next section of this chapter reviews the institutional payment factor and provides background on HCFA's current policy. The second section describes the data used to analyze the separate effect of institutional status on Medicare expenditures. The third section discusses how well the base PIPDCG model predicts expenditures for the institutionalized. The fourth section describes the analytic model(s) used to analyze the effect of institutional

status on Medicare expenditures. The fifth section discusses the results of the analysis and the sixth section summarizes salient findings and issues.

7.1 Background on the AAPCC Institutional Status Payment Factor

Using self-reported data from the Current Medicare Survey (CMS) for the years 1974 through 1976, Kunkel and Powell (1981) derived the original set of official AAPCC payment (cost) factors. The 1999 AAPCC institutional cost factors for the aged are shown in Table 5-4. These factors are generally thought to overstate the extra costs associated with institutionalization. Both Manton and Stallard (1992) and an internal HCFA analysis cited in GAO (1998) estimated substantially lower factors. But, for various reasons including lack of data, Kunbel and Powell's original factors have not been greatly revised since their inception.

Whitmore, *et al.* (1989) summarized several criticisms of the AAPCC institutional payment factor:

> - Institutionalization has not been defined in a standardized manner, and it is hard to measure reliably.
> - Significant variations exist in long term care availability, leading to different levels of morbidity being associated with institutionalization.
> - Patient institutionalization is subject to provider practice variation and possibly to provider manipulation.
> - Disability and functional limitation may adequately reflect the high cost factors currently associated with the institutional classification, thus making the classification unnecessary. (Whitmore, *et al.*, 1989, p. 77)

These criticisms still hold, at least to some degree. With regard to the first, HCFA recently issued a directive that clarified the definition of an institution and episode duration in order to qualify for an institutional status payment adjustment.[1] But concerns about definition and reporting still exist (GAO, 1998). While the general availability of long-term care institutions has probably increased during the past ten years, there are still geographic areas (most likely rural) where availability is more limited than elsewhere. Patient institutionalization is still subject to provider practice variation. Provider manipulation remains an on-going public policy concern. A recent U.S. General Accounting Office report (GAO, 1998) expressed several concerns about provider manipulation. For instance, the GAO noted that individual physicians affiliated with one HMO did not respond to a request by their HMO's management to correct reports on the institutional status of the HMO's Medicare enrollees, leading to a substantial overreporting of institutional status. Another aspect of institutional status that could be the target of provider manipulation is the type of facility in which Medicare beneficiaries are domiciled. While HCFA's 1997 Operational Letter might have clarified the definition of an institution, the GAO still has concerns that there are instances in which it is inherently ambiguous as to whether a facility qualifies as an institution.

HCFA's Operational Policy Letter dated July 24, 1997 (reproduced as Appendix 7-B of this chapter) specifies the criteria by which an HMO can receive an institutional payment adjustment for a Medicare enrollee. A Medicare enrollee must have been a resident of a

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[1] Operational Policy Letter #54 (July 24, 1997).

certified institution(s) for the last day of the month prior to the month for which the higher institutional rate is paid, and for the 29 prior consecutive days. This qualifying period of residency, rather than the calendar month, must be satisfied for each month that the enrolling health maintenance organization or competitive medical plan (HMO/CMP) is paid at the higher institutional rate. Certified institutions under HCFA's definition include the following types:

- skilled nursing facilities (SNF) or units (SNUs);
- nursing facilities (NF);
- intermediate care facilities for the mentally retarded (ICF/MR) ;
- psychiatric hospitals or units;
- rehabilitation hospitals or units;
- long-term care hospitals; and
- swing beds in general hospitals.

7.2 Data

Institutional status is not available in HCFA's enrollment or claims files;[2] rather, it is reported by HMOs to HCFA. Additionally, there are no "institutional status" reporting requirements for FFS beneficiaries. Thus, it is impossible to estimate the effect of institutional status on Medicare expenditures using claims data from the 5% beneficiary Standard Analytical File (SAF). Instead, several years of the Medicare Current Beneficiary Survey (MCBS), a population-based panel survey of about 12,000 Medicare beneficiaries per

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[2] We extensively explored using place of service indicators and CPT nursing home codes on Part B Medicare claims to define institutional status for our 1995/1996 claims/enrollment file. But we concluded that assignment of institutional status using this method was not sufficiently accurate (see Appendix 7-A).

year, were used to estimate the association of institutional status with Medicare expenditures. Since the MCBS sample is much smaller than the 1995/1996 5% SAF described in Chapter 2, it was used *only* to analyze the institutional factor.

Data from Rounds 1, 4, 7, and 10 of the MCBS were used, which include information, respectively, for 1991, 1992, 1993, and 1994. Annual Medicare expenditures, age, sex, and Medicaid enrollment were obtained from the MCBS analytic files created for a previous Health Economics Research, Inc. (HER) project for HCFA (Pope, *et al.*, 1998b). The sample selection criteria and Medicare expenditure definition were identical to those employed in our previous large-sample claims analysis (Ellis *et al.*, 1996), and thus very similar to those used in this project, as described in Chapter 2. The Medicaid indicator on the MCBS file is defined as one or more months of Medicaid eligibility (buy-in) in the base year. MCBS years were paired for analysis of prospective risk adjustment. That is, 1992 expenditures were predicted by 1991 beneficiary characteristics, 1993 expenditures were explained by 1992 characteristics, and 1994 expenditures were explained by 1993 characteristics. So three years of expenditures – 1992, 1993, and 1994 – were explained by prior (base) year characteristics.

Medicare expenditures in our MCBS analysis are not completely comparable to the expenditure definition used in our 5% sample analysis. MCBS Medicare expenditures include both Indirect Medical Education (IME) and hospice care payments, while these two types of payments are excluded from our 5% sample analysis. IME payments can not be easily removed from MCBS data. Hospice payments account for a very small portion of total

payment, so we did not remove them. In sum, in our MCBS analysis, we analyze total Medicare payments.

For this project, we added several new demographic variables to our previously created MCBS files, including working aged, ever-disabled, and prediction-year institutional statuses. Information about working aged and ever disabled was obtained for each person from the Medicare enrollment file using the crosswalk of MCBS BASEID and HICNO. Working aged is defined as the number of months with employer-based group insurance in the prediction year, and was created for each of 1992, 1993, and 1994. For the same reasons as in the 5% sample analysis, the working aged are excluded from the MCBS analysis. As a result, 107 working aged beneficiaries were excluded from the MCBS study sample, including 25 in 1992, 45 in 1993, and 37 in 1994. Ever disabled status was created as of January 1 of each prediction year.

Institutional status was created from facility event records (RIC FAE) and institution event records (RIC IUE) from the *Cost and Use* files of the MCBS for 1992 to 1994. RIC FAE files contain all the facility stays for each respondent reported during a Facility interview. RIC IUE files contain short-term facility stays that were reported either during a "community interview" or created through Medicare claims data. They are primarily SNF stays.

The *Cost and Use* files of the MCBS contain selected utilization information, including institutional stays, for attriters. Attriters are individuals that died or otherwise declined to further participate in the MCBS survey prior to being interviewed during the final

"round" in the prediction year. There were 1,888 attriters between 1991 and 1992, 1,274 attriters between 1992 and 1993, and 1,249 attriters between 1993 and 1994. Our analysis of institutional status for the attriters, as well as for continuing respondents, indicates that the institutional status variables are appropriately coded. The number of attriters that were institutionalized, during the prediction year, was not unduly high or low.

The rates of institutionalization in the MCBS are 5.7 percent in 1992, 6.7 percent in 1993, and 5.8 percent in 1994, with a three-year average of 6.0 percent.[3] Overall MCBS sample sizes are 10,893 in 1992, 10,532 in 1993 and 10,910 in 1994. To increase the sample size for the analysis, we pooled three years of data rather than analyze each year separately.

7.3 Actual Expenditures Compared to Expenditures Predicted by the Base PIPDCG Model

Institutional status is currently used in the AAPCC methodology as a concurrent monthly risk adjuster. For each prior month in a certified institution, a beneficiary is paid at the higher institution rate cell amount the following month. For our analysis, we also defined institutional status concurrently, as the fraction of the prediction year institutionalized; that is, the number of institutional months in the prediction year divided by

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[3] The rates are weighted by sampling weights.

the number of Medicare eligible months.[4] Institutional months are defined according to the 1997 HCFA Operational Policy Letter.

The effect of institutional status is estimated using the pooled MCBS data. A predicted expenditure for each individual from the base PIPDCG model (Model (4) from Table 5-2) is used in our analysis. It is based on age; sex; interactions of Medicaid status with age and sex; interactions of ever disabled status with age and sex; and principal hospital diagnoses. The Medicaid variable used in this section is defined as one or more months of Part B Medicaid buy-in in the base year. Both actual Medicare expenditures and predicted expenditures from the MCBS sample are normalized to have the same mean payment as the 1996 Medicare expenditures from our claims/enrollment file, $5,186. Hence, dollar amounts can be compared directly between the 1992-1994 MCBS analysis reported in this section, and the analyses of the 1995/1996 5% sample file described elsewhere in this report.

Table 7-1 compares mean actual expenditures and mean expenditures predicted by the base PIPDCG model for MCBS sample subgroups. As expected, predictive ratios (mean predicted divided by mean actual expenditures) for the overall sample, age and sex subgroups, and Medicaid status are close to 1.0. Concurrent institutionalization is associated with substantially higher actual Medicare expenditures than those of the average beneficiary ($8,570 versus $5,186). But the base PIPDCG model predicts average expenditures for the

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[4] Since our expenditure variable is measured annually, and is not tracked by month, our institutional months variable is correlated with expenditures throughout the year, not just in the months during institutionalization. This is particularly relevant for the post-acute care population. For example, if a beneficiary is hospitalized and then has a SNF stay during a calendar year, our institutional variable will reflect the acute hospital costs in addition to any elevated expenditures during or after institutionalization. Our annual-expenditure estimate of the institutional factor is thus biased upwards relative to an estimate based on monthly expenditure data.

institutionalized very accurately, almost exactly in this sample. Hence, an additional payment adjustment for the institutionalized as a group is unnecessary. The base PIPDCG model predicts their average expenses accurately without such an adjustment.

Certified institutions under HCFA's definition (Appendix 7-B) include both post-acute and long-term care facilities. Post-acute care facilities include Skilled Nursing Facilities (SNFs). Long-term care facilities include nursing homes, mental health facilities, and Intermediate Care Facilities for the Mentally Retarded (ICF/MRs). Three quarters of the institutionalized are in nursing homes. Half of the remainder are in SNFs or the SNF/nursing home combination. About seven percent are in ICF/MRs, and three percent are in mental health facilities.

Not surprisingly, mean actual Medicare expenditures (payments) for beneficiaries that have been admitted to post-acute care facilities are far greater than those admitted to long-term care facilities. For example, beneficiaries in SNFs are the most expensive group, with mean expenditures of $46,159, while nursing home residents have an average Medicare payment of only $6,371. The base PIPDCG model greatly under-predicts the expenditures of people in post-acute care facilities. The predictive ratio is only 0.16 for SNFs and 0.31 for SNF/nursing home. It is virtually impossible for a prospective risk adjustment model to accurately predict individuals' acute-care costs, which are mostly random. Conversely, the base PIPDCG model overpredicts expenses for the three-quarters of the institutionalized in nursing homes, by 38 percent on average. An institutional status adjustment to the PIPDCG model for nursing home residents alone would be negative.

About half of the institutionalized were enrolled in Medicaid in the prior (base) year, a much greater proportion of Medicaid enrollment than the 15 percent among the entire Medicare population who are dual eligible. The Medicaid institutionalized have only slightly higher expenses (less than seven percent higher) than the Medicaid population as a whole. Thus, unlike the general Medicare population, institutionalization is associated with only slightly elevated expenses in the Medicaid population. Predicted expenditures, however, are substantially higher for the Medicaid institutionalized, resulting in an overprediction of 20 percent. Actual expenses may be lower than predicted expenses because of substitution of Medicaid-reimbursed long term care for Medicare services or lower intensity of services for frail elderly. Actual expenditures are greater for the institutionalized who were not Medicaid enrolled, and these expenditures are underpredicted 18 percent by the base PIPDCG model. The non-Medicaid institutionalized are more likely to be in post-acute care, or in the early, more acutely-ill phase of nursing home residence, before they have 'spent down' to become eligible for Medicaid. Overall, the overprediction for dual eligibles just balances the underprediction for non-duals so that the model predicts accurately for the institutionalized as a whole.

Mean months institutionalized per year differentiates post-acute and long-term care facilities (Table 7-2). Individuals in SNFs average only 1.32 institutional months per year, while beneficiaries in nursing homes average 10.28 institutional months. Persons with mixed SNF and nursing home stays are intermediate, averaging 6.60 institutionalized months.

7.4 Institutional Status Payment Models

The preferred payment model developed in Chapter 5 accurately predicts Medicare expenditures for the institutionalized as a whole even though an institutional payment factor was not included in the model. However, as shown in Table 7-1, for some institutionalized sub-populations such as beneficiaries receiving post-acute care in SNFs and non-Medicaid eligibles, the base model underpredicts expenditures substantially. We investigate regression models containing an explicit institutional payment factor to determine if the "fit" for institutional subpopulations can be improved.

The principles used to construct payment models for the working aged (see Chapter 6) were also used to develop payment models for the institutionalized. Both are 'second stage' models where the effect of working aged or institutionalization is estimated relative to the 'first state' prediction from the base PIPDCG model. An important difference between the two types of payment models is that the working aged were not included in the PIPDCG model development sample whereas the institutionalized were. Our models for the institutionalized, then, are estimated on the entire MCBS sample, not just the sample of those who were institutionalized during the year. The institutional models imply changes in payment for the non-institutionalized.

Following the development in Chapter 6, but replacing 'working aged' with 'institutionalized', annualized Medicare payments for total months when the beneficiary is institutionalized are:

$$MP^{I} \equiv INSTF \cdot \left(\alpha^{I} + \beta^{I} \cdot PE\right) \tag{7-1}$$

and annualized Medicare payments for total months when the beneficiary is not institutionalized are:

$$MP^{NI} \equiv (1 - INSTF) \cdot (\alpha^{NI} + \beta^{NI} \cdot PE) \qquad (7\text{-}2)$$

where MP is Medicare capitation payments, the 'I' and 'NI' superscripts indicate institutionalized and non-institutionalized months, respectively, INSTF is the fraction of eligible prediction-year months institutionalized, PE is 'first stage' predicted expenditures, and α is the additive effect and β is the multiplier effect relative to first stage predictions. Combining the two equations and using the resulting total annualized payments to predict actual annualized Medicare expenditures (AE), the general regression specification is ('e' is an error term):

$$AE = \alpha^{NI} + (\alpha^{I} - \alpha^{NI}) \cdot INSTF + \beta^{NI} \cdot PE + (\beta^{I} - \beta^{NI}) \cdot INSTF \cdot PE + e \qquad (7\text{-}3)$$

Note that this specification has a constant term, α^{NI}, so it will be unbiased for the overall mean. Using a similar rationale for the variations to the basic working aged specification in Chapter 6, variations of Equation 7-3 are also estimated.

7.5 Results

We now turn to the impact of adding institutional status to the risk adjustment regression models. Age, sex, and Medicaid status are included in the second stage regressions so that predictions remain unbiased by these groups. We explore both additive

and multiplicative functional forms for the institutional status adjustment. An additive adjustment does not vary with the PIPDCG score, whereas a multiplicative form does. An additive adjustment is estimated by inserting a variable for fraction of months in institutional status into the regression. A multiplicative adjustment is estimated by interacting the institutional fraction variable with the PIPDCG score (first stage PIPDCG prediction). We also allow for interactions between institutional status and Medicaid status. Because of limited sample sizes, all models we estimated employ a single institutional indicator, incorporating all facility types.[5]

7.5.1 Demographic Models

The second-stage regression models are presented in Table 7-3. Model (1) is the first demographic model, including age, sex, Medicaid status, and institutional status, without a Medicaid/institutional interaction. Medicare payments for Medicaid dual eligibles and the institutionalized are each estimated to be about $2,000 higher, or about $3,874 higher for someone both Medicaid enrolled and institutionalized. Model (2), which adds the interaction of Medicaid and institutional status, shows how misleading the Model (1) estimates are. Model (2) allows the effect of institutional status to vary between Medicaid and non-Medicaid populations. Predicted payments for the non-Medicaid institutionalized in Model

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[5] We estimated all models using weighted least squares (WLS). Ideally, we would use a variance components estimation to correct for the longitudinal nature of the MCBS sample. However, this estimator is rather cumbersome to work with for the large number of exploratory models we estimate. Our previous MCBS analysis (Pope *et al.*, 1998) shows that the variance component estimates are similar to WLS except that, as expected, significance levels are somewhat reduced.

(2) are more than double those predicted by Model (1), while predicted payments for the Medicaid institutionalized are nearly halved. Predicted expenses for Medicaid non-institutionalized rise by nearly $600. Without an interaction term, Model (1) grossly underpredicts the separate effects of Medicaid and institutionalization, while grossly overpredicting expenditures of the Medicaid institutionalized. In analyzing the institutionalized, it is important to separate Medicaid eligibles from non-Medicaid eligibles.

As revealed in Model (2), the non-Medicaid institutionalized are more expensive than dual eligibles in institutions. This is probably because they are in post-acute care, or are in an earlier, more acute or episodic phase of their long-term care tenure, before they have spent down to Medicaid status. Predicted payments of the Medicaid institutionalized are somewhat lower that those of the non-institutionalized Medicaid. In other words, institutionalized dual eligibles appear to have slightly lower average Medicare expenditures than dual eligibles living in the community. This may be because nursing home care is substituting for Medicare-covered acute care services (e.g., hospital care) for the institutionalized dual eligibles.

7.5.2 Second-Stage PIPDCG Models

In Models (3) to (9), we include the PIPDCG score. Various models include or exclude interactive Medicaid/institutional effects. The PIPDCG score includes a Medicaid effect since Medicaid status is one of the payment factors in the first-stage regression. This is why the separate Medicaid variable is statistically insignificant in models (3)-(9).

A single additive factor for institutional status is used in Model (3). Controlling for prior year principal hospital diagnoses, institutional status is associated with $793 higher Medicare payments. Model (4) adds the interaction of Medicaid and institutional status to Model (3) with the result that institutionalized are associated with $2,560 higher Medicare payments. Off-setting this to some extent, of course, is the large negative coefficient on the interaction of institutional status with Medicaid status.

Models (5) through (7) include both the additive and multiplicative effects of institutional status, with and without Medicaid interactions. Model (5) does not include interactions of institutional status with Medicaid status. The coefficient of $5,003 for the additive institutional factor is partially offset by the reduced multiplier associated with institutional status, which is 0.40 (0.92-0.52). Mean predicted expenditures for the institutionalized, from the PIPDCG base model, are $8,534 (Table 7-1). Thus, the net effect of institutionalization on Medicare expenditures for an institutionalized person with mean predicted expenditures is approximately $565 (=5003 - (0.52 × 8534)).

Model (6) adds to Model (5) a multiplicative interaction of institutional and Medicaid statuses with the PIPDCG score. This shows that the multiplier to the first stage PIPDCG prediction is greater for the non-Medicaid than the Medicaid institutionalized. Model (7) is the full model, including additive and multiplicative institutional effects and their interactions with Medicaid status. It shows a large, positive additive institutional effect ($6,363) coupled with a net multiplier (0.92 - 0.52 = 0.40) for the institutionalized that is

well below 1.00. Medicaid status cuts the additive effect of institutionalization more than in half, but has little impact on the multiplier.

Model (8) is an institutional multiplier only model. No additive effects or Medicaid interactions are included. The coefficient (-0.08) for the multiplier is only marginally statistically significant at the 10 percent level. Additionally, the absolute magnitude of the multiplier is close to zero. In other words, the second stage net multiplier for the institutionalized is close to the second-stage multiplier for the non-institutionalized, i.e., there is little institutional effect. Model (9) allows the single institutional multiplier to vary by Medicaid versus non-Medicaid status. As in Model (8), no additive institutional effect is allowed. The non-Medicaid institutionalized have a slightly higher net multiplier than the non-institutionalized (0.97 versus 0.88), while the net multiplier for the Medicaid institutionalized is only 0.59 (0.88 - 0.29).

In our second stage models, the multiplier on the PIPDCG score for the non-institutionalized population is less than one, and the constant term is greater than zero, both by a statistically significant amount. This implies that payments to the non-institutionalized population should rise less rapidly than predicted by the base PIPDCG model – the regression coefficients imply by about 90 percent as much. Changing the payment formula of the non-institutionalized population might be regarded as undesirable if the institutional factor is regarded simply as an "add-on." These small differences in the 'slope' and 'intercept' of the payment formula between the MCBS and 5% samples could arise from survey non-response to the MCBS or other differences in samples.

To determine if a second-stage model improves predictions for institutionalized subgroups, we calculated predictive ratios analogous to those in Table 7-1 for Model (4) in Table 7-3. The results are shown in Table 7-4. The predictive ratios for institutional facility types are quite similar to those in Table 7-1 from the first-stage PIPDCG model. There is little improvement. But the predictive ratios for the institutionalized who are and are not on Medicaid are much closer to one. This improvement can clearly be attributed to the Medicaid/institutional interaction in Model (4). Undoubtedly, a better 'fit' for institutional facility types could also be obtained by introducing specific factors for them into the institutional regressions. We did not estimate such models partly because of small sample sizes by facility type and partly because we do not believe it is desirable to perfectly match payments to facility type (see the next section).

7.6 Discussion

We feel that Table 7-1 of descriptive statistics is the best one to focus on when thinking about the institutional status adjustment. It shows that the base PIPDCG model with age, sex, hospital diagnoses, and Medicaid and ever disabled status predicts expenditures accurately on average for institutionalized beneficiaries. So an explicit, separate adjustment for institutional status is unnecessary to achieve payment accuracy. Table 7-1 also shows that the institutional population as currently defined by HCFA contains two distinct sub-populations, a very expensive post-acute care population receiving SNF care, and a much less expensive long-term-care sub-population in nursing homes. Expenditures predicted by

the base PIPDCG model exceed actual expenditures for the nursing home group. An institutional status adjustment for nursing home residents would be negative, which might discourage needed institutional care. The only question, then, is whether Medicare should increase its capitation payments to health plans for enrollees who are currently using post-acute care services.

We say no. A prospective risk adjustment model is not intended to accurately predict or pay for random, acute health care expenditures. Random health events are insurable, and this risk is properly borne by health plans. It is not a shortcoming of the prospective PIPDCG model that it underpredicts the expenditures of individuals receiving post-acute care in the prediction (payment) year. Prospective models similarly underpredict the expenditures of beneficiaries who are hospitalized in the prediction year, which again, are largely random events. If Medicare pays more for post-acute care in the prediction year through an institutional status adjustment, why not also pay more for prediction year hospitalizations? The answer to this rhetorical question is that both defeat the purpose of prospective risk adjustment.

In addition to these conceptual and empirical shortcomings, an institutional status adjustment suffers from data limitations. Institutional status is not routinely collected by HCFA as part of its administrative activities, but is reported by health plans to HCFA. As noted in Section 7.1, plans are not aware of the institutional status of all their enrollees, and reporting is spotty. Lack of administrative data on institutional status in fee-for-service also makes estimation of an accurate institutional factor difficult. And the concurrent nature of

the institutional status adjustment means that neither plans nor HCFA can precisely budget or plan Medicare capitation payments in advance. Reconciliation will be necessary once concurrent institutional status has been determined, raising the administrative burden on HCFA and on plans.

Finally, an institutional status adjustment establishes poor incentives. Unlike age, sex, and ever disabled, Medicaid, and working aged status, institutionalization is subject to direct manipulation by health plans. It is an endogenous decision of health care providers whether to institutionalize, especially for post-acute care. SNF and other post-acute care expenditures have been skyrocketing. Paying health plans more for SNF usage will do nothing to discourage this trend. Why bias the decisions of providers among alternative treatment modalities? An institutional adjustment will encourage more SNF and other institutional admissions, and encourage lengthening of stays so that the 30-day rule to qualify as an institutional stay is met.

Many states are working to reduce Medicaid-paid nursing home stays. They are encouraging provision of home- and community-based long-term care services as an alternative to nursing home stays. Higher Medicare payments only for institutionalized beneficiaries would appear to run counter to these initiatives of state Medicaid programs. Frail non-institutionalized beneficiaries who are living in the community may be equally or more expensive to Medicare than institutionalized beneficiaries.

If, despite these significant shortcomings, HCFA decides to implement an institutional status adjuster as part of risk adjustment, we favor an additive adjustment only,

with a Medicaid interaction. An additive adjustment avoids the complexities of a multiplicative adjustment, but guarantees that mean payments are correctly calibrated for the institutionalized. A Medicaid interaction is crucial, because the expenditures of the Medicaid institutionalized are much lower than of the non-Medicaid institutionalized. Estimates of our preferred institutional status adjustment model are given in Table 7-3 as Model (4).

Table 7-1

Actual Compared to Predicted Expenditures, MCBS Data

	Observations	Mean Annualized Expenditures		Predictive Ratio
		Actual	Predicted*	
Entire sample	32,228	5,186	5,186	1.00
Neither Medicaid nor Institutionalized	25,369	4,547	4,723	1.04
Institutionalized, all	2,715	8,570	8,534	1.00
Nursing Home only	2,044	6,371	8,766	1.38
All other situations	671	18,412	7,496	0.41
SNF only	77	46,159	7,209	0.16
SNF/Nursing Home	261	33,364	10,278	0.31
Mixed	27	34,315	8,833	0.26
ICF/MR	195	3,040	4,407	1.45
Mental Health	82	6,312	6,268	0.99
Hospital	21	3,463	7,356	2.12
Rehab	8	8,313	8,613	1.04
Medicaid	5,471	7,131	7,612	1.07
Medicaid and Institutionalized	1,327	7,617	9,164	1.20
Not Medicaid and Institutionalized	1,388	9,605	7,849	0.82
Age 0-64	5,202	4,739	4,608	0.97
Age 65-74	11,152	4,264	4,162	0.98
Age 75-84	10,921	5,941	6,075	1.02
Age 85+	4,953	7,735	7,936	1.03
Male	13,559	5,327	5,308	1.00
Female	18,669	5,088	5,101	1.00

*From PIPDCG Model 4 on Table 5-2. Includes age; gender; Medicaid and Ever-Disabled interacted with age and gender; and diagnoses.

OUTPUT: MCBS21G.OUT

SOURCE: Health Economics Research, Inc. analysis of 1991-1994 Medicare Current Beneficiary Survey data.

Table 7-2

Mean Months Institutionalized by Type of Facility, From MCBS Data

Type of Facility	Number of Persons	Average Months
Nursing Home Only	2,044	10.28
All Other Situations	671	7.52
Hospital	21	9.88
SNF	77	1.32
SNF/Nursing Home	261	6.60
Mental Health	82	10.85
ICF/MR	195	11.45
Rehab	8	10.83
Mixed Facilities	27	8.60

SOURCE: Health Economics Research, Inc. analysis of 1991-1994 Medicare Current Beneficiary Survey data.

Table 7-3

Second Stage Regressions Including Institutional Status, Using MCBS Data

Model:	1		2		3		4		5	
	Demographic Factors		Demographic Factors + INST*Medicaid		Additive INST		Additive INST + INST*Medicaid		Additive & Multiplicative INST	
Number of Observations:	32,228		32,228		32,228		32,228		32,228	
R-Squared:	0.008390		0.009281		0.039483		0.040035		0.040576	
Dependent Variable Mean:	5,186		5,186		5,186		5,186		5,186	
Root Mean Square Error:	15,265		15,258		15,024		15,020		15,016	
Model Parameters:	6		7		7		8		8	
Computer Output:	VALID01A		VALID01B		VALID01A		VALID01A		VALID01A	
Variable	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**
Intercept	3,809	26.11	3,760	25.74	657	3.79	634	3.65	431	2.43
Age Groups[†]:										
0-64	-319	-1.00	-447	-1.40	167	0.53	64	0.20	56	0.18
75-84	1,583	8.09	1,556	7.95	5	0.03	-8	-0.04	-88	-0.44
85+	2,930	9.52	2,851	9.25	139	0.44	90	0.29	23	0.07
Male	666	3.77	694	3.93	13	0.08	38	0.22	-9	-0.05
Medicaid	1,900	6.85	2,476	8.34	-359	-1.27	106	0.35	-383	-1.36
PIPDCG Score[‡]	-	-	-	-	0.87	32.30	0.86	32.13	0.92	32.49
Institutionalized	1,974	4.50	4,211	6.97	793	1.83	2,560	4.29	5,003	6.11
INST*Medicaid	-	-	-4,583	-5.38	-	-	-3,608	-4.30	-	-
INST*PIPDCG	-	-	-	-	-	-	-	-	-0.52	-6.06
INST*Medicaid*PIPDCG	-	-	-	-	-	-	-	-	-	-

Table 7-3 (continued)

Second Stage Regressions Including Institutional Status, Using MCBS Data

Model:	6		7		8		9	
	Additive & Multi. INST + Mult. INST*Medicaid		Additive & Multi. INST + Medicaid Interaction		Multiplicative INST		Multiplicative INST + Mult. INST*Medicaid	
Number of Observations:	32,228		32,228		32,228		32,228	
R-Squared:	0.040786		0.040931		0.039465		0.03979	
Dependent Variable Mean:	5,186		5,186		5,186		5,186	
Root Mean Square Error:	15,014		15,013		15,024		15,022	
Model Parameters:	9		10		7		8	
Computer Output:	VALID01A		VALID01B		VALID01B		VALID01B	
Variable	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**
Intercept	436	2.46	431	2.43	600	3.42	596	3.40
Age Groups[†]:								
0-64	-3	-0.01	-14	-0.05	157	0.50	78	0.25
75-84	-90	-0.45	-91	-0.45	27	0.14	18	0.09
85+	-3	-0.01	-4	-0.01	345	1.11	293	0.94
Male	4	0.02	14	0.08	-1	-0.01	13	0.08
Medicaid	-131	-0.44	-8	-0.03	-151	-0.54	146	0.50
PIPDCG Score[‡]	0.92	32.20	0.92	32.09	0.88	31.94	0.88	31.73
Institutionalized	4,766	5.78	6,363	5.81	-	-	-	-
INST*Medicaid	-	-	-3,525	-2.21	-	-	-	-
INST*PIPDCG	-0.37	-3.57	-0.52	-4.20	-0.08	-1.65	0.09	1.30
INST*Medicaid*PIPDCG	-0.23	-2.66	0.07	0.46	-	-	-0.29	-3.30

[†] Age 65-74 is the omitted category.

[‡] From PIPDCG Model 4 on Table 5-2. Includes age; gender; Medicaid and Ever-Disabled interacted with age and gender, and hospital diagnoses.

NOTE: INST is "institutionalized".

SOURCE. Health Economics Research, Inc. analysis of 1991-1994 Medicare Current Beneficiary Survey data

Table 7-4

Predictive Ratios from Second-Stage Institutional Regression*
(Model 4)

		Expenditures (Payments)		
	Observations	Actual	Predicted*	Predictive Ratio
Entire sample	32,228	5,186	5,186	1.00
Neither Medicaid nor Institutionalized	25,369	4,547	4,734	1.04
Institutionalized, all	2,715	8,570	8,676	1.01
Nursing Home only	2,044	6,371	8,924	1.40
All other situations	671	18,412	7,566	0.41
SNF only	77	46,159	7,248	0.16
SNF/Nursing Home	261	33,364	10,258	0.31
Mixed	27	34,315	9,262	0.27
ICF/MR	195	3,040	4,407	1.45
Mental Health	82	6,312	6,483	1.03
Hospital	21	3,463	8,416	2.43
Rehab	8	8,313	7,934	0.95
Medicaid	5,471	7,131	7,196	1.01
Medicaid and Institutionalized	1,327	7,617	7,877	1.03
Not Medicaid and Institutionalized	1,388	9,605	9,542	0.99

* Model (4) of Table 7-3 including an additive institutional effect and an institutional/Medicaid interaction.

Computer Output: MCBS25_4.OUT

SOURCE: Health Economics Research, Inc. analysis of 1991-1994 Medicare Current Beneficiary Survey data.

Appendix 7-A

Defining Institutional Status Using Medicare Part B Claims

As an alternative to analyzing institutional status with the Medicare Current Beneficiary Survey, we attempted to define institutional status using Medicare claims in our much larger 1995/1996 claims/enrollment file. Except for stays in skilled nursing facilities (SNFs), Medicare Part A does not cover stays in long-term care institutions. However, professional services during institutional stays are covered by Medicare Part B. Therefore, we used Medicare Part B claims to define institutional status. Ultimately we concluded that our claims-based method was not sufficiently accurate in identifying institutional stays for use in our payment analysis. We report methodological details here for the benefit of other researchers or future work that may consider using this method.

There are no Federal rules or regulations that require regular physician visits for nursing home residents under Medicaid. The Federal Technical Advisory Group for Medicaid programs recommends that, after exhausting Medicare SNF coverage, Medicaid eligibles in nursing homes should have one physician visit every 30 days for the first 90 days, then one physician visits every 60 days afterwards. However, states have their own regulations governing physician visits for nursing home residents, which differ from state to state.

Institutional status is defined concurrently as of the prediction year (1996). Two types of claims are used, Part B and durable medical equipment (DME) files, to identify physician visits or DME utilization when individuals are institutionalized. The algorithm used to identify potential institutionalized Medicare beneficiaries is as follows.

1. Identify Part B services used during the periods of institutionalization using "place of service" codes and CPT codes on the claims. Claims that meet one of the following criteria are categorized as services used during institutionalization.

   1) Place of service = 31 (skilled nursing facilities), 32 (nursing facilities), 51 (inpatient psychiatric facilities), 54 (ICF/MR), or 61 (comprehensive inpatient rehabilitation); or

   2) CPT codes = 99301-99303, 99311-99313 (evaluation and management services for patients in nursing facilities including SNF, ICFs, LTC, psychiatric facilities)

   Long-term care and swing bed hospitals are categorized as hospitals in the "place of service" code. Therefore, the services provided in long-term care and swing bed hospitals are not included. However, utilization in long-term care hospitals may be picked up by the above CPT codes, which include services performed in long-term care facilities.

2. Define dates of service using the "through date" of each claim. Keep the unique dates of service for each person. These unique dates of services indicate that individuals are institutionalized around the dates of service.

3. Categorize the unique dates of service by calendar month for each individual. We assume that an individual is institutionalized in a calendar month, if the individual has at least one unique date of service in the month.

4. In order to avoid including short stays, institutional status is defined as a person with the above utilization in at least three different calendar months. Two institutional status variables are created:

   1) An annual indicator of institutional status (INSTD): The INSTD is a dichotomous variable, with 1 indicating individuals with at least three different calendar months of institutionalization in the prediction year (1996); 0 otherwise. The annual indicator gives the same weight to everyone with institutional status regardless of length of stay;

   2) A bimonthly count of institutional status based on the calendar month (INSTM): If a person is institutionalized in January and/or February, then we assume that this person is institutionalized for these two months, similarly in March and/or April, May and/or June, etc. The value of INST ranges from 2 to 12, with an interval of 2. For example, if a person has

> Part B claims identified above in March, May, June, and August, then the INSTM is 6 for this person. INSTM allows us to downweight short stays.

Appendix Table 6-1 displays mean expenditure by type of facility for individuals with institutional status (INSTD = 1). Based on our method, 81,881 individuals are identified as qualifying for institutional status in the prediction year, which accounts for 5.8% of the study sample. The largest proportion of institutionalized people (38.8%) are in both SNFs and nursing homes in a year, followed by those in SNFs (32.5%), and in nursing homes (17.4%). People in rehab facilities have the highest mean Medicare expenditure ($35,784). Mean expenditures are $30,552 for people in SNFs, $11,432 for nursing home residents, and $17,609 for those in both SNFs and nursing homes.

We identify very few cases in ICF/MRs (0.6%). These people are less expensive with a mean Medicare expenditure of $2,683. There are several possible explanations. First, Medicare does not cover ICF/MR, therefore people in ICF/MR do not incur many Part B claims. Second, people in ICF/MR are relatively healthy, so they have fewer Part B claims. Third, people in ICF/MRs are undertreated.

Although the percentage of the sample considered institutionalized, and the relative payment levels, in Appendix Table 6-1 appear reasonable, the distribution among different institutional types, and the mean payment levels, do not. Compared to Table 7-1 generated from the MCBS, our claims-based algorithm appears to grossly understate the proportion of nursing-facility-only residents. Also, the proportion in ICF/MRs appears to be greatly understated. Conversely, the proportion in SNFs, and SNFs/nursing facilities, appears to be greatly overstated. And the mean payment level of the institutionalized is more than double overall using the claims algorithm. It appears that we are identifying a much more

expensive, acutely-ill, shorter-stay population centering on SNF users with our claims algorithm. Since we believe that the MCBS is relatively accurate in identifying the institutionalized, we conclude that our claims-based algorithm does not accurately identify the Medicare institutionalized population. We did not employ it in our analysis.

There are several limitations in defining institutional status based Medicare Part B claims.

1. The method provides only an approximation of institutional status. Medicare claims-based measures of institutional status do not accurately reflect episodes of institutionalization. They will 'miss' persons in nursing facilities if these persons are not regularly receiving Medicare-covered services, or if place of service is not accurately coded on the Medicare claims.

   Institutional status may not include persons who are in long-term care or swing bed hospitals, because these facilities are not categorized under the "place of service" code.

   Institutional status may not include people in institutions who are covered under private insurance or Medicaid.

   Institutional status may overestimate Medicare expenditures due to the following reasons:

   1) The definition of institutional status in this study may overestimate the number of people who would qualify for the institutional rate under HCFA's definition, which is more restrictive in terms of dates. For example, suppose a person went into a nursing home twice in a year - one admission from March 10 to April 25 and another one from June 3 to July 27. This person won't qualify for the institutional rate according to HCFA's definition. If this person has Part B claims in March, April, June, and July, then this person would be considered to have institutional status under our definition from claims.

   2) The method may include short SNF stays that are more expensive and may not qualify for institutional rates under the HCFA's definition. For example, a person with services used in three different calendar months is considered to have institutional status under our definition, however, the person may have three short SNF stays instead.

3) The method of using Part B claims to define institutional status will not include persons who are institutionalized and have few or no Part B claims. These people are likely to use fewer professional services and be less costly.

Several approaches to improving the definition of institutional status using Medicare claims could be explored. First, Medicare Part A SNF claims could be used to accurately identify Medicare SNF stays, and in particular, exclude SNF stays that are too short to qualify as institutional stays. Second, episodes of institutionalization could be created using Part B claims. Episodes could be defined by ‘gaps’ in the presence of claims indicating institutionalization under the assumption that the institutionalized receive regular visits or other services. Third, Medicare and Medicaid claims could be merged to identify people in nursing homes.

Appendix Table 7-1

Mean Payment[1] by Type of Facility for Individuals with Institutional Status[2]

Type of Facility	N	Percent	Mean Payment
SNF	26,609	32.5%	$20,552
Nursing Home	14,223	17.4	$11,432
SNF/Nursing Home	31,735	38.8	$17,609
Psychiatric Facility	2,706	3.3	$16,726
ICF/MR	515	0.6	$2,683
Rehab Facility	2,168	2.6	$35,784
Other Mixed Facilities	3,925	4.8	$33,959
Total	81,881	100.0	$18,662

NOTE:

[1] Including IME payments; weighted by fraction of year alive.

[2] Institutional status is defined based on place of service and CPT codes from Medicare Part B claims in 1996.

SOURCE: 1995/1996 Medicare Claims.

OUTPUT: DIAG55.OUT

Appendix 7-B

Change in the Definition of an Institution for Purposes of Adjusting Payments to Risk Contracting Managed Care Organizations

Department Of Health & Human Services
Health Care Financing Administration
Center for Health Plans and Providers (CHPP)
Medicare Managed Care
Operational Policy Letter # 54
OPL97.054

Date: **July 24, 1997**

Subject: **Change in the Definition of an Institution for Purposes of Adjusting Payments to Risk Contracting Managed Care Organizations**

BACKGROUND AND PROBLEM

Risk contracting health maintenance organizations and competitive medical plans (HMO/CMPs) are paid 95 percent of the standardized per capita rates of payment modified by certain demographic cost factors (AAPCCs) One of the demographic categories, *institutional status*, refers to Medicare beneficiaries who are under care or custody in institutions.

HMO/CMPs are generally paid a higher AAPCC for their Medicare enrollees who have been patients or residents of certain types of institutions for at least 30 days In the past, HCFA has specified "nursing homes, sanatoriums, rest homes, convalescent homes, long-term care hospitals, and domiciliary homes" as the permissible types of institutions These groupings for type of institution were used by the U S Census Bureau in connection with special surveys of Medicare beneficiaries performed some years ago HCFA adopted this terminology since the AAPCC demographic cost factors for institutionalized enrollees were developed largely in part from data collected through the Census Bureau surveys

CHPP has encountered many technical problems in using this terminology to determine when a higher AAPCC payment is justified Generic terms such as "nursing homes" or "rest homes" can represent a wide variety of institutions The terminology lacks specific criteria describing what is required of a facility for it to be considered a permissible institution This has led to various interpretations by different parties In addition, HCFA, the Office of Inspector General, and the General Accounting Office are concerned about the potential for making improper payments to HMOs and CMPs by continuing to use inexplicit terminology

We are issuing this Operational Policy Letter to provide a clear definition regarding the type of facilities which are designated as institutions for the purpose of receiving the institutional AAPCC payment

DEFINITION

To be considered institutionalized, an enrolled member must have been a resident of one of the following title XVIII (Medicare), or title XIX (Medicaid) certified institutions for at least 30 consecutive days immediately prior to the month for which an AAPCC payment is being made

a) a skilled nursing facility (SNF) as defined in section 1819 (Medicare), or
b) a nursing facility (NF) as defined in section 1919 (Medicaid), or
c) an intermediate care facility for the mentally retarded (ICF/MR) as defined in section 1905(d), or
d) a psychiatric hospital or unit as defined in section 1886(d)(1)(B), or
e) a rehabilitation hospital or unit as defined in section 1886(d)(1)(B), or
f) a long-term care hospital as defined in section 1886(d)(1)(B), or
g) a hospital which has an agreement under section 1883 (a swing-bed hospital).

In an enrolled member's case who qualifies under (g), the enrolled member must be receiving post-hospital extended care services as defined in section 1883 or NF services as defined in section 1913.

Brief Explanations

a) SNF -- An institution, or distinct part of an institution, primarily engaged in providing skilled nursing care or rehabilitative services to residents which has in effect an agreement with a hospital that ensures transfer of patients will be affected between the two whenever such transfer is medically appropriate

b) NF -- Same explanation as SNF as described above In addition, it includes institutions that provide health-related care and services to residents who because of their mental or physical condition require care and services which can be made available to them only through institutional facilities

c) ICF/MR -- An institution that provides health or rehabilitative services for mentally retarded residents receiving active treatment under Medicaid

d) Psychiatric Hospital -- An institution, or distinct part of an institution, primarily engaged in providing, by or under the supervision of a physician, psychiatric services for the diagnosis and treatment of mentally ill persons

e) Rehabilitation Hospital -- An institution that serves an inpatient population of whom the vast majority require intensive rehabilitative services for the treatment of certain conditions, e g., stroke, amputation, brain or spinal cord injuries, and neurological disorders

f) Long-Term Care Hospital -- A hospital which has an average inpatient length of stay of greater than 25 days.

g) Swing-Bed Hospital -- A hospital which has entered into an agreement under which its inpatient hospital facilities may be used for the furnishing of services of the type which, if furnished by a SNF, would constitute extended care services

RESIDENCY REQUIREMENT

A Medicare enrollee must have been a resident of the above institutions for a minimum of 30 consecutive days which includes, as the 30th day, the last day of the month prior to the month for which the higher institutional rate cell is paid This qualifying period of residency must be satisfied each month in order for the HMO/CMP to be paid at the higher institutional rate

Temporary absences. HCFA will continue to pay the institutionalized AAPCC payment rate while an enrolled member is temporarily absent from the facility for hospitalization or therapeutic leave if a bed in being held and paid for on behalf of the member Temporary interruptions (less than 15 days) for medical necessity will be counted toward the 30-day requirement

In order to clarify the residency requirement, the use of the term "calendar month" cannot be used A calendar month can have 28 to 31 days and thus cannot be substituted for 30 days For example, in a month with 31 days, a beneficiary would have to be institutionalized from the 2nd - 31st day of the month to meet the requirements for reporting institutionalized status.

The following examples are being provided to clarify these residency requirements

1. A member of a risk contracting organization enters an institution identified above on March 2. On March 20, the individual is hospitalized for a surgical procedure. On April 2, the individual is discharged from the hospital, re-enters the institution, and remains there continuously through April 15 The individual does meet the residence requirement. The HMO/CMP will be paid the institutional rate for the month of April

2. Mr X, a Medicare member (effective April 1) of a risk contracting HMO, enters one of the institutions identified above on April 15 and remains there continuously until his discharge on May 25 He does not meet the criteria for reporting institutionalized status. Although he was institutionalized for at least 30 consecutive days, it was not the 30 consecutive days which includes the last day of the month as the 30th day, as required His stay would have had to continue through May 31 in order to be reported for a payment adjustment for the month of June

3. Mr Y, a Medicare member (effective April 1) of a risk contracting HMO, had entered one of the institutions identified above on February 28 and remains there continuously until his discharge on April 25. He does meet the criteria for reporting institutionalized status for April to be paid the institutional rate for the month of April. Although he was not a member of the HMO during the qualifying period of residency (March 2 through March 31), Mr. Y was institutionalized for at least 30 consecutive days which includes the last day of the month as the 30th day (It is not required that Mr Y be a member of the HMO during the qualifying period of residency) Therefore, the risk contracting HMO would be paid the institutional rate for the month of April. The HMO would not be paid the institutional rate for the month of May because the qualifying period of residency (April 1 through April 30) was not satisfied

EFFECTIVE DATE OF DEFINITION

The Office of the Actuary is updating the cost factors used to make the institutional payment adjustment. They will include only the data relevant to patients in title XVIII (Medicare) and title XIX (Medicaid) certified institutional facilities as outlined above This will match the new definition of institutional facilities with the demographic cost factors used to determine payment rates The new demographic cost factors are announced in the 45-day notice pertaining to the upcoming 1998 AAPCC's scheduled to be released on July 24 Therefore, the revised definition of which Medicare enrollees are institutionalized will be effective for all institutional payment rate adjustments made for those months beginning after December

Contact:

HCFA Regional Office Managed Care Staff

8

Excluding Diagnoses from Short Hospital Stays

A person's diagnosis is used for risk adjustment in the PIPDCG model only if the person is hospitalized. This gives health plans an incentive to allow hospitalization of enrollees to increase future payments. In its utilization review of hospital admissions, the health plan weighs the expected marginal revenue and marginal costs of the hospitalization along with the benefits of treatment to the patient. Even if hospitals are largely altruistic, raising the marginal cost of getting a hospital diagnosis "counted" in risk adjustment will tend to reduce the incentive to hospitalize. Excluding diagnoses from short-stay hospital admissions is one way to raise the marginal cost of getting a hospital diagnosis counted. For example, only diagnoses from stays of two or more days could be counted.

8.1 Advantages and Disadvantages of Excluding Short Stays

Excluding short stay diagnoses has pros and cons. If length of stay is a proxy for severity of illness, short-stay patients may be less severely ill, and thus less expensive in the future, than longer-stay patients. Excluding short stay diagnoses could improve, or at least not degrade very much, the accuracy of the risk adjustment model in predicting future expenses. Short stay hospitalizations may be highly substitutable for certain diagnostic and therapeutic procedures, drug administration, observation, screening, "rule out" diagnoses, etc., that are often appropriately performed in the outpatient setting. Attaching a

substantially greater future payment to inpatient, as opposed to outpatient, performance of these tests and procedures gives health plans a strong incentive to move them back to the hospital. Excluding short stay diagnoses limits this incentive. Finally, excluding diagnoses from short stays eliminates penalties to health plans that avoid unnecessary short stay admissions.

Excluding short stay diagnoses has corresponding disadvantages. Although short-stay patients may be less expensive in the future than longer-stay patients, they tend to be more expensive than non-hospitalized patients. Excluding them could reduce the risk adjustment model's predictive accuracy. While excluding short stay diagnoses may lessen incentives for hospitalization, paying more only when diagnoses come from longer stays gives health plans an incentive to increase length of stay. For example, if only diagnoses from stays of two days or more are used in risk adjustment, plans have an incentive to increase stays that are appropriately one day to two days to get the diagnosis counted in risk adjustment. Manipulating length of stay is probably easier than increasing the admission rate. Excluding short stay diagnoses penalizes plans that are effective in reducing inappropriately long hospital stays. Finally, short stays will sometimes be clinically appropriate and indicated. Clinical review of the appropriateness of hospital admissions--such as by Peer Review Organizations under Medicare's PPS--is a more refined approach to excluding inappropriate admissions than a blanket exclusion of one day stays.

8.2 Empirical Evidence on Length of Stay Distribution and Costs

In this section, we provide empirical evidence on the distribution of length of stay among hospital admissions, the relative costs of short stays versus longer stays, differences in distribution and relative costs by diagnosis, and the effects of excluding short stay diagnoses on the PIPDCG payment model.[1] We are not able to observe or accurately predict the sensitivity of health plan admission rates to implementation of the PIPDCG model, nor the sensitivity of admission rates or length of stay to excluding short stay diagnoses. However, we can empirically evaluate the cost in predictive accuracy of excluding short stays, and the numbers of cases that are subject to incentives to admit versus incentives to increase length of stay.

To be sure, our data are from 1995 fee-for-service Medicare. Admission rates and length of stay distributions could be different among beneficiaries enrolled in Medicare HMOs. Significant regional variations in admission rates and length of stay may exist. And, patterns in hospital use are likely to evolve over time as technology advances and practice patterns change. These important caveats should be kept in mind as we examine hospital use and costs in our 1995 fee-for-service data.

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[1] Throughout this chapter and the report, transfer cases are counted as two admissions, each with their own diagnosis and length of stay.

8.2.1 Distribution of Admissions by Length of Stay

Table 8-1 shows the distribution of hospital admissions by length of stay. Two distributions are shown. The first is for all admissions in our sample. The second is for admissions that determine assignment to PIPDCG 5 or greater in the base PIPDCG model. Recall that assignment to PIPDCG 5 or greater in the base year is necessary for the principal hospital diagnosis to trigger elevated capitation payments in the next year. In 1995, total admissions were 415,231, but only 167,677 determined assignment to PIPDCG 5 or above. This is because some diagnoses are excluded from the PIPDCG payment model, or are assigned to PIPDCG 4 (which includes people with no admissions), and only the single most expensive diagnosis determines PIPDCG assignment when a person has multiple admissions during the year.

Zero day stays (i.e., admission date the same as discharge date--not staying overnight) are rare in both samples of admissions, less than one percent of the total.[2] One day stays are more common, but not as frequent as two to five day stays, which are the most frequent. Around 20 percent of admissions have stays of 10 or more days.

As expected, a relatively lower proportion of short stays, and a relatively higher proportion of long stays, are used to assign PIPDCGs than are present among all admissions. This is because less clinically serious or well-defined diagnoses are excluded from the payment model. In particular, only 7 percent of admissions used for PIPDCG assignment

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[2] Throughout this report, we define length of stay as discharge date minus admission date. This differs from the definition of LOS under Medicare's PPS for hospitals, which adds one to our definition. Thus, what we call a 'zero day stay' PPS defines as a 'one day stay', and what we refer to as a 'one day stay' PPS labels a 'two day stay'.

are 0 or 1 day stays. Our data are from traditional fee-for-service (FFS) Medicare. The average proportion of 0 or 1 day stays may be greater among managed care plans, which tend to reduce length of stay. But, at least in our FFS data, excluding diagnoses from less than two day stays from the payment model would exclude only a small proportion (one in 15) of principal hospital diagnoses not already excluded. On the other hand, if diagnoses from all admissions of less than three days were excluded, a more significant proportion--17 percent, or one in 6—of principal hospital diagnoses would be dropped.

8.2.2 Future Costs of Beneficiaries with Short Versus Longer Stays

How do future expenditures for people with short versus longer stays compare? Table 8-2 examines this issue.[3] The regression predicts actual 1996 payments using expenditures predicted by the PIPDCG payment model, and length of stay indicator (dummy) variables interacted with predicted expenditures. The length of stay variables are defined only for the 167,677 admissions used to assign PIPDCGs 5 or greater in the payment model. The coefficient on predicted expenditures is expected to be 1.0 because predicted expenditures are unbiased for actual expenditures.[4] The coefficients of the length of stay variables show the percentage difference of actual from predicted expenditures, by length of stay. For

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[3] The regression shown in Table 4-12 uses a multiplicative model. We also estimated an additive model regressing residuals from the PIPDCG payment model regression (Model 3 of Table 4-4--not shown in Table 4-12) on length of stay for comparison and validation. We prefer the multiplicative model because it allows the difference between actual and predicted expenditures to vary by the level of predicted expenditures.

[4] When we included an intercept term in Model 1, it was slightly negative, and the coefficient on predicted expenditures was slightly greater than one, so we reestimated the model without an intercept term. This "no intercept" model is shown in Table 4-12.

example, the coefficient of length of stay one is –0.17, implying that actual expenditures average 17 percent lower than expenditures predicted by the PIPDCG model for people with one day stay diagnoses that determine PIPDCG assignment. Equivalently, expenditures predicted by the PIPDCG model from one day stay diagnoses should be multiplied by 0.83 to predict actual expenditures more accurately.

As expected, the regression shows that future Medicare payments are lower for people whose PIPDCG is assigned by shorter stays. The future payments associated with zero day stays are estimated to be 5 percent lower, although this magnitude is not estimated precisely because of small sample sizes. One and two-day stays are associated with 17 and 16 percent lower future expenses, respectively. Future expenses are below average for all stays until 7 days. People with long stays of 10 or more days are 20 percent more expensive next year.

We conclude that people with short stays are substantially less expensive on average than predicted by the PIPDCG model. However, the relationship between length of stay and future expenditures is continuous. There is no threshold length of stay below which future payments are much lower than predicted, and above which payments are as large or larger than predicted.

8.2.3 Future Costs of Short Versus Longer Stays by PIPDCG

In Table 8-3, we examine the future expenses of short versus longer stays by PIPDCG. The PIPDCG payment model[5] is modified by splitting people in each PIPDCG into those whose PIPDCG was assigned based on a short stay (0, 1 days), versus those whose PIPDCG was assigned from a longer stay (2 or more days). Both components of each PIPDCG—short and longer stay—are included in the regression estimating future cost level.

For most PIPDCGs, the future costs associated with short stays are lower than for longer stays, by $600 to $10,000[6]. The cost gap tends to be larger in absolute dollars for the higher-numbered, more expensive, PIPDCGs. But for all PIPDCGs, short hospital stays are associated with higher future costs than no hospital stay[7], and diagnosis is a strong predictor of future costs among short stays, as the short stay coefficients are much larger for the higher-numbered PIPDCGs.

The estimates in Table 8-3 could form the basis for a policy of including short stays in the PIPDCG payment model, but raising future capitation payments by a smaller amount than for longer stays. This would be a compromise between reducing incentives to admit, and establishing incentives to lengthen stays. But it would be more complex administratively than simply including or excluding short stays.

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[5] The model used in Table 8-3 includes age, sex, and PIPDCG only. Medicaid and ever disabled status are excluded because they add complexity without being essential to this analysis.

[6] For PIPDCG 18, the future expenses of beneficiaries with shorter stays are estimated to be slightly higher than the expenses of those with longer stays.

[7] The short stay coefficients for PIPDCGs 5, 6, and 7 are not statistically significant at the 5 percent level.

8.2.4 Future Cost of Short Versus Longer Stays by Diagnosis

Table 8-4 shows frequencies and mean future expenditures of people with one day[8] versus two or more day stays by diagnosis (PIPDxG). The sample sizes of one-day stays are small for many diagnoses, so only diagnoses with at least 50 short stay admissions, and that are included in the payment model, are shown. As expected, short stays are associated with lower future costs for many diagnoses. But this pattern is not universal. For example, people admitted for one day for Chronic Obstructive Pulmonary Disease (PIPDxG 105) have significantly higher future costs than those with longer lengths of stay. Also, one-day stays for several of the psychiatric disorders—such as Major Depression (DxG 60) and Alcohol/Drug Dependence (DxG 64)—appear to be associated with greater future expenditures than longer stays.

The percentage of one-day stays varies widely across diagnosis. Some diagnoses included in the payment PIPDCG model have large proportions of one-day stays. These include: Breast Cancer (DxG 14), Cancer of Bladder, Kidney, Urinary Organs (DxG 19), Unstable Angina (DxG 83), Angina Pectoris (DxG 84), and Fractures of Skull/Face (DxG 145). Other included diagnoses have very small percentages of one day stays. In terms of absolute numbers of one-day stays, certain heart diagnoses--Coronary Atherosclerosis (DxG 80), Unstable Angina (DxG 83), and Atrial Arrhythmia (DxG 86)--are the most frequent.

Although general patterns do exist, we conclude that the frequency and relative future cost of one day stays varies substantially across diagnoses, even among those included in the

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[8] Zero day stays are included with one day stays.

PIPDCG payment model. Hence, excluding one day stays disproportionately affects certain diagnoses. Future work could attempt to refine a policy excluding short stays by considering relative cost, frequency, and clinical appropriateness by diagnosis.

8.2.5 PIPDCG Payment Model with Short Stays Excluded

To illustrate the effects of excluding short stays, we reestimated the PIPDCG model excluding short stays. The results are given in Tables 8-5 and 8-6. For simplicity, we include only age, sex, and PIPDCG, but not Medicaid or ever disabled status, in the Table 8-5 models. The Table 8-6 model includes Medicaid and ever disabled statuses. In Table 8-5, Model 1 is the base payment model, including admissions of all lengths of stay. Model 2 excludes 0 and 1 day stays, and Model 3 excludes 0, 1, and 2 day stays in assigning PIPDCGs. Excluding short stays lowers model explanatory power, but not by very much. Excluding 0 and 1 day stays lowers the R-square from 5.72 percent to 5.69 percent; also excluding 2 day stays reduces the R-square to 5.62 percent. The incremental payments (coefficients) for the PIPDCGs and age/sex do not change much as 0 and 1, then 2 day stays are excluded, but tend to rise slightly. The PIPDCG coefficients tend to rise because higher future expenses are associated with the longer admissions remaining in each PIPDCG when short stays are excluded. The age/sex coefficients tend to increase because people admitted for short stays are more expensive than those with no or excluded admissions.

In Table 8-6, we show the base PIPDCG payment model (Model 4 from Table 5-2) with diagnoses from stays of less than 2 days not used to assign PIPDCGs.[9] This is the same as Model (2) of Table 8-5 except that Medicaid and ever disabled statuses, interacted with the age/sex cells, are added to the model. The coefficient estimates are similar between the base model with (Table 8-6) and without (Model 4 of Table 5-2) short stays excluded. The PIPDCG coefficients tend to rise slightly when the less expensive, on average, short stays are excluded. The age/sex coefficients also rise slightly as people with short stay admissions are assigned only to the demographic cells. When short stays are excluded, the explanatory power of the model (R-square) falls slightly.

Table 8-7 contains a rate cell presentation of the base PIPDCG model with short stays excluded (the model in Table 8-6). It may be compared to the similar rate cells in Table 5-3 for the base model with short stays included, and to the AAPCC rate cells in Table 5-4.[10] The rate cell factors with and without short stays excluded are quite similar. Most of the PIPDCG factors rise slightly, as do a few of the demographic factors.

8.3 Conclusions and Recommendations on Short Stays

The future expense of people admitted for short (one day) stays is 17 percent lower than people with longer admissions for the same diagnosis. But it is higher than the future

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[9] The number of observations (people) for each of the interactions of Medicaid and ever disabled with the age/sex cells are shown for informational purposes. They may be useful in actuarial smoothing of the regression coefficients.

[10] The working aged rate cell factors can be obtained by multiplying the factors in Table 8-7 by the working aged multiplier of 0.21 (see Chapter 6). Working aged rate cell factors for the 'never disabled, non-Medicaid' group are shown in Table 6-3.

expense of people with no admissions. Excluding short stays lowers the predictive accuracy of the model, but only slightly. Zero day stays are very rare, and one day stays are infrequent in our 1995 fee-for-service data. Only 7 percent of admissions that assign a PIPDCG with a greater future incremental payment are zero or one day stays. Two day stays are more common.

Two policy options for HCFA are

- include short stays in the payment model; or
- exclude short stays from the payment model.

Reasonable arguments can be made for either of these options. Our clinical panel, in particular, felt that short stays are often clinically appropriate and should not be excluded. Our clinical panel, in particular, felt that short stays are often clinically appropriate and should not be excluded. The danger is that added payments for inpatient diagnoses will encourage additional, inappropriate short stay admissions. Our physician panel stressed the importance of monitoring admission patterns under risk adjustment as a means of controlling inappropriate behavior by plans. Clinical review of admission decisions has precedent in the Peer Review Organization (PRO) review of admissions paid under Medicare's Prospective Payment System (PPS). However, ex post monitoring and judging the clinical appropriateness of the many thousands of admission decisions by individual providers and plans is a monumental task.

A more feasible, albeit less clinically cogent, approach is to establish a minimum threshold length of stay required for an inpatient diagnosis to be 'counted' in the payment

model. The greatest danger of inappropriate behavior by plans is encouragement of relatively inexpensive short stay admissions. As a policy matter, excluding diagnoses from these admissions may strike the best balance of administrative feasibility, protection of the Medicare program against manipulation by health plans, and fairness to plans and beneficiaries. There is no reason that a risk adjustment policy need be based on admissions per se only. Length of stay can also be considered. Longer length of stay is a proxy for greater severity of illness (i.e., longer-stay patients, on average, have greater future costs). For the implementation of risk adjustment, focussing only on the more severely-ill longer-stay patients, while eliminating the sensitivity of payments to increased short stay admission of less ill patients, is a reasonable policy decision.

In our 1995 Medicare FFS data, only 7 percent of admissions used to assign payment PIPDCGs are zero or one day stays. Thus, if additional future payments for short stays were denied, only a small proportion of admissions would be subject to incentives to increase length of stay. This contrasts with the large numbers of people who are diagnosed with illnesses included in the PIPDCG payment model, but are not admitted for the diagnosis (see the 'admission rate' column in appendix Table A-1). Shifting a significant number of these patients from outpatient settings to inpatient wards for short stay diagnostic testing, or minor procedures and therapies, would seem relatively low cost and attractive to health plans. For a relatively small cost in terms of introducing incentives to inappropriately increase the lengths of 1-day hospital stays, excluding short stays could achieve a significant improvement in terms of reduced incentive to admit patients to the hospital.

However, our 1995 FFS data may not be representative of current managed care practice patterns. If managed care organizations are very successful at reducing length of stay, their proportion of short stays may be much higher than our data indicates. Incremental payments based on diagnosis might be foregone for a much larger number of (relatively sick) enrollees, and a higher proportion of admissions might be subject to incentives to lengthen stays. Moreover, excluding short stays might disproportionately disadvantage managed care organizations in certain areas if substantial regional variations in length of stay exist. Excluding short stays requires obtaining and auditing an additional data item, length of stay, which imposes additional administrative burden and complexity on HCFA and on plans that report inpatient encounter data.

In the end, we make no consensus recommendation on whether short stay diagnoses should be included or excluded from HCFA's capitation payments. We recommend further consideration of this issue once hospital encounter data from managed care plans become available. HCFA has reported to us that payment simulations using actual managed care data indicate that the effect on aggregate Medicare payments to HMOs of including versus excluding short stays is less that 0.7 percent.

Table 8-1

Length-of-Stay Distribution for All Admissions Versus Those That Determine PIPDCG Assignment

	All Admissions*		PIPDCG Admissions[†]	
Length of Stay in Days	Percent	Cumulative Percent	Percent	Cumulative Percent
0	0.7	0.7	0.4	0.4
1	7.7	8.4	6.2	6.5
2	12.0	20.5	10.3	16.8
3	13.5	33.9	11.9	28.7
4	12.3	46.2	11.4	40.1
5	10.1	56.3	9.8	49.9
6	8.3	64.6	8.4	58.3
7	7.0	71.6	7.4	65.7
8	5.3	76.8	5.7	71.4
9	3.8	80.7	4.3	75.8
10+	19.3	100.0	24.2	100.0

*Total admissions = 415,231.

[†] Admissions that assign a person to PIPDCG 5 or higher in the base PIPDCG model (Model 4 of Table 5-2).
Total admissions = 167,677.

NOTE: 1995 hospital admissions.

OUTPUT: All admissions: NEW077B.OUT
DCG admissions: NEW081B.OUT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims.

Table 8-2

Regression of Actual Expenditures on Predicted Expenditures Interacted With Length-of-Stay

---

Number of Observations:	1,387,105	
R-Squared[*]:	--	
Dependent Variable Mean:	5,186	
Root Mean Square Error:	13,550	
Model Parameters:	12	
Computer Output:	NEW081D.OUT	
Variable	**beta**	**t-ratio**
Predicted Expenditures[†]	0.999	352.96
Predicted Expenditures[†] Interacted With:		
Length of Stay 0 Days	-0.050	-1.15
Length of Stay 1 Day	-0.168	-12.89
Length of Stay 2 Days	-0.156	-17.04
Length of Stay 3 Days	-0.123	-15.61
Length of Stay 4 Days	-0.090	-11.80
Length of Stay 5 Days	-0.057	-7.04
Length of Stay 6 Days	-0.055	-6.40
Length of Stay 7 Days	0.012	1.35
Length of Stay 8 Days	0.020	1.96
Length of Stay 9 Days	0.066	5.79
Length of Stay 10 or More Days	0.199	35.21

---

[*] The model was estimated without an intercept.

[†] Predicted expenditures from the base PIPDCG model, Model 4 of Table 5-2.

NOTE: Length of stay is defined only for admissions that assign a person to PIPDCG 5 or greater.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 8-3

Future Expenses of Short Versus Longer Stays by PIPDCG

Number of Observations:	1,387,105
R-Squared[*]:	--
Dependent Variable Mean:	5,186
Root Mean Square Error:	13,599
Model Parameters:	54
Computer Output:	NEW081E.OUT

Variable	beta	t-ratio
AGE/SEX GROUPS:		
MALE: 0-34	2,315	17.93
MALE: 35-44	2,732	28.96
MALE: 45-54	3,056	34.83
MALE: 55-59	3,584	29.60
MALE: 60-64	4,203	39.16
MALE: 65-69	3,214	76.20
MALE: 70-74	3,885	103.55
MALE: 75-79	4,847	111.74
MALE: 80-84	5,677	103.52
MALE: 85-89	6,555	81.32
MALE: 90-94	7,126	50.25
MALE: 95+	7,139	25.04
FEMALE: 0-34	2,464	14.98
FEMALE: 35-44	3,009	24.82
FEMALE: 45-54	3,469	32.29
FEMALE: 55-59	4,167	30.07
FEMALE: 60-64	5,276	43.71
FEMALE: 65-69	2,835	74.84
FEMALE: 70-74	3,373	104.64
FEMALE: 75-79	4,185	118.83
FEMALE: 80-84	5,036	123.77
FEMALE: 85-89	5,830	111.93
FEMALE: 90-94	6,149	79.12
FEMALE: 95+	5,853	44.52

	beta	t-ratio
PIPDCG Interactions With Length of Stay:		
PIPDCG 5:		
< 2 day stay	858	1.29
2 + day stay	2,004	5.94
PIPDCG 6:		
< 2 day stay	1,682	1.68
2 + day stay	2,285	6.61
PIPDCG 7:		
< 2 day stay	1,882	1.42
2 + day stay	3,839	11.68
PIPDCG 8:		
< 2 day stay	3,240	12.62
2 + day stay	4,286	48.93
PIPDCG 9:		
< 2 day stay	4,044	7.90
2 + day stay	4,811	49.16
PIPDCG 10:		
< 2 day stay	4,730	10.67
2 + day stay	6,204	52.81
PIPDCG 11:		
< 2 day stay	4,840	9.03
2 + day stay	6,780	68.92
PIPDCG 12:		
< 2 day stay	6,512	15.52
2 + day stay	8,818	100.79
PIPDCG 14:		
< 2 day stay	8,113	8.00
2 + day stay	10,710	62.85
PIPDCG 16:		
< 2 day stay	8,554	19.39
2 + day stay	12,809	149.94
PIPDCG 18:		
< 2 day stay	14,417	10.81
2 + day stay	14,061	72.80
PIPDCG 20:		
< 2 day stay	12,616	12.24
2 + day stay	17,884	92.35
PIPDCG 23:		
< 2 day stay	15,562	11.72
2 + day stay	19,952	88.38
PIPDCG 26:		
< 2 day stay	20,106	13.16
2 + day stay	21,141	49.76
PIPDCG 29:		
< 2 day stay	18,148	7.87
2 + day stay	28,282	59.40

---

[*] Model is estimated without an intercept.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 8-4

Comparison of Short and Longer Stay 1995 Frequencies and 1996 Mean Expenditures, by Diagnosis (PIPDxG)

PIPDxG	Label	Percentage One-Day Stays[†]	Frequency One-Day Stays[†]	Expenditures One-Day Stays[†]	Frequency Two+ Day Stays	Expenditures Two+ Day Stays	Ratio, Short/Longer Expenditures
7	Metastatic Cancer	7.1	125	23,583	1,471	25,447	0.93
13	Lung Cancer	3.3	56	18,625	1,484	18,119	1.03
14	Breast Cancer	20.3	459	5,206	1,779	7,378	0.71
15	Blood, Lymphatic Cancers/Neoplasms	4.6	50	28,952	885	29,911	0.97
16	Cancer of Uterus/Cervix/Female Genital Organs	6.2	59	8,407	789	9,419	0.89
18	Cancer of Prostate/Testis/Male Genital Organs	10.7	242	7,049	1,945	7,640	0.92
19	Cancer of Bladder, Kidney, Urinary Organs	17.8	305	12,041	1,225	13,314	0.90
21	Other Cancers	14.4	61	10,521	328	13,884	0.76
27	Diabetes with Chronic Complications	5.3	165	19,376	2,537	23,313	0.83
32	Pancreatitis/Other Pancreatic Disorders	4.7	108	18,203	1,914	12,592	1.45
36	Peptic Ulcer	4.0	161	9,587	3,735	10,961	0.87
39	Abdominal Hernia, Complicated	7.6	66	8,341	789	9,499	0.88
42	Gastrointestinal Obstruction/Perforation	5.5	369	12,203	5,596	13,763	0.89
45	Gastrointestinal Hemorrhage	7.1	197	13,627	2,425	15,032	0.91
48	Rheumatoid Arthritis and Connective Tissue Disease	7.7	92	14,082	984	14,328	0.98
55	Blood/Immune Disorders	6.2	97	25,491	1,087	21,334	1.19
56	Dementia	3.7	137	13,339	3,127	14,208	0.94
57	Drug/Alcohol Psychoses	8.2	88	18,653	870	14,706	1.27
59	Schizophrenic Disorders	2.7	184	15,049	3,924	12,809	1.17
60	Major Depression/Manic and Depressive Disorders	3.1	283	19,910	6,021	14,986	1.33
61	Paranoia and Other Psychoses	5.6	69	13,266	1,031	15,531	0.85
64	Alcohol/Drug Dependence	7.1	206	16,661	1,802	12,361	1.35
73	Epilepsy and Other Seizure Disorders	10.1	261	13,734	2,056	16,267	0.84
77	Valvular and Rheumatic Heart Disease	6.7	126	12,205	1,619	11,276	1.08
79	Hypertension, Complicated	10.8	67	11,311	536	12,230	0.92
80	Coronary Atherosclerosis	14.4	3,051	10,494	15,224	11,217	0.94
81	Post-Myocardial Infarction	11.8	64	11,229	457	12,946	0.87
82	Acute Myocardial Infarction	6.4	767	9,080	9,704	11,571	0.78
83	Unstable Angina	16.6	1,064	11,680	4,844	12,967	0.90

Table 8-4 (continued)

Comparison of Short and Longer Stay 1995 Frequencies and 1996 Mean Expenditures, by Diagnosis (PIPDxG)

PIPDxG	Label	Percentage One-Day Stays[†]	Frequency One-Day Stays[†]	Expenditures One-Day Stays[†]	Frequency Two+ Day Stays	Expenditures Two+ Day Stays	Ratio, Short/Longer Expenditures
84	Angina Pectoris	21.5	423	9,545	1,482	12,316	0.78
86	Atrial Arrhythmia	14.8	1,152	8,621	5,962	11,639	0.74
87	Paroxysmal Ventricular Tachycardia	9.2	101	10,727	853	14,271	0.75
88	Cardio-Respiratory Failure and Shock	3.2	92	18,735	2,437	23,828	0.79
89	Congestive Heart Failure	3.9	935	17,633	17,784	18,820	0.94
91	Cerebral Hemorrhage	4.3	58	14,349	1,188	14,500	0.99
92	Precerebral Arterial Occlusion	8.5	487	7,915	4,695	10,660	0.74
93	Stroke	2.9	331	11,329	10,206	14,665	0.77
94	Transient Cerebral Ischemia	10.7	533	10,275	4,315	12,492	0.82
95	Atherosclerosis of Major Vessel	7.6	220	12,393	2,357	19,639	0.63
96	Aortic and Other Arterial Aneurysm	3.8	72	11,754	1,709	9,734	1.21
97	Thromboembolic Vascular Disease	2.0	114	14,826	5,201	13,725	1.08
98	Peripheral Vascular Disease	9.4	135	16,607	1,227	16,134	1.03
105	Chronic Obstructive Pulmonary Disease	3.3	461	21,386	10,424	19,000	1.13
109	Bacterial Pneumonia	1.5	254	14,173	15,045	14,990	0.95
110	Asthma	6.4	100	13,332	1,269	13,693	0.97
113	Pleural Effusion/Pneumothorax/Empyema	5.5	65	15,446	993	16 230	0.95
133	Cellulitis and Bullous Skin Disorders	2.3	109	13,309	4,333	14,789	0.90
147	Hip Fracture	1.1	120	13,363	9,712	11,381	1.17

* The table includes diagnoses that are (1) included in the payment model; and (2) have frequencies of 50 or more for both one-day and two or more day stays.

[†] Also includes zero day stays.

OUTPUT: NEW077A.OUT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 8-5

PIPDCG Model With Short Stays Excluded

Model:	**1=BASE**		**2***		**3****	
	Base Model		**Base Model w/LOS > 1**		**Base Model w/LOS > 2**	
Number of Observations:	1,387,105		1,387,105		1,387,105	
R-Squared:	0.057202		0.056910		0 056245	
Dependent Variable Mean:	5,186		5,186		5,186	
Root Mean Square Error:	13,600		13,602		13,607	
Model Parameters:	39		39		39	
Computer Output:	NEW081A		NEW081A		NEW081A	
Variable	**beta**	**t-ratio**	**beta**	**t-ratio**	**beta**	**t-ratio**
AGE/SEX GROUPS:						
MALE: 0-34	2,318	17.96	2,315	17.93	2,314	17.91
MALE: 35-44	2,731	28.95	2,734	28.98	2,739	29.02
MALE: 45-54	3,054	34.80	3,059	34.85	3,070	34.96
MALE: 55-59	3,582	29.58	3,590	29.65	3,604	29.76
MALE: 60-64	4,201	39.14	4,211	39.23	4,224	39.33
MALE: 65-69	3,212	76.16	3,218	76.29	3,226	76.44
MALE: 70-74	3,882	103.47	3,889	103.64	3,899	103.88
MALE: 75-79	4,846	111.71	4,853	111.87	4,866	112.14
MALE: 80-84	5,677	103.52	5,687	103.69	5,706	104.01
MALE: 85-89	6,557	81.32	6,567	81.44	6,588	81.68
MALE: 90-94	7,130	50.27	7,141	50.34	7,151	50.39
MALE: 95+	7,149	25.07	7,154	25.08	7,162	25.10
FEMALE: 0-34	2,468	15.00	2,479	15.07	2,498	15.18
FEMALE: 35-44	3,012	24.84	3,020	24.90	3,036	25.02
FEMALE: 45-54	3,471	32.31	3,478	32.37	3,486	32.43
FEMALE: 55-59	4,167	30.07	4,178	30.15	4,195	30.26
FEMALE: 60-64	5,275	43.69	5,289	43.80	5,301	43.88
FEMALE: 65-69	2,834	74.83	2,837	74.88	2,841	74.96
FEMALE: 70-74	3,373	104.64	3,376	104.73	3,383	104.90
FEMALE: 75-79	4,186	118.85	4,191	118.98	4,200	119.19
FEMALE: 80-84	5,039	123.84	5,044	123.94	5,056	124.21
FEMALE: 85-89	5,835	112.02	5,841	112.11	5,853	112.31
FEMALE: 90-94	6,154	79.18	6,160	79.24	6,171	79.36
FEMALE: 95+	5,857	44.55	5,860	44.57	5,874	44.66
PIPDCGs[†]:						
5	1,771	5.88	1,814	6.01	1,791	5.88
6	2,224	6.80	2,173	6.63	2,136	6.52
7	3,717	11.65	3,800	12.00	3,912	12.48
8	4,187	50.45	4,203	50.80	4,230	51.32
9	4,779	49.69	4,791	49.82	4,845	50.50
10	6,122	53.76	6.202	53.91	6,269	54.13
11	6,736	69.53	6,737	69.43	6,778	69.61
12	8,724	101.75	8,709	101.22	8,724	100.83
14	10,621	63.12	10,596	62.69	10,588	62.22
16	12,662	150.74	12,698	150.37	12,728	148.71
18	14,068	73.56	14,008	73.03	14,066	72.79
20	17,699	92.89	17,768	92.57	17,619	90.50
23	19,858	89.08	19,832	88.32	19,906	87.84
26	21,125	51.49	21,034	51.38	21,180	51.80
29	27,802	59.58	27,711	59.38	27,014	57.25

* Admissions of 0 or 1 days are not considered in DCG assignment.

** Admissions of 0, 1 or 2 days are not considered in DCG assignment.

[†] PIPDCG 4 is the omitted category, which includes all persons without 1995 hospital admissions, or excluded or certain low-cost admissions only

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 8-6

PIPDCG Model With Additional Demographic Factors, With Short Stays Excluded

	BASE Model With Full Interactions of Medicaid & Ever Disabled With Age and Sex
Number of Observations:	1,387,105
R-Squared:	0.061759
Dependent Variable Mean:	5,186
Root Mean Square Error:	13,568
Model Parameters:	74
Computer Output:	DIAG123C.OU2

Variable	beta	t-ratio	Number of Observations for Interacted Categories
DEMOGRAPHIC INTERACTIONS:			
MALE: 0-34*Medicaid	607	2.16	8,054
MALE: 35-44*Medicaid	1,487	7.91	11,518
MALE: 45-54*Medicaid	1,886	10.13	8,296
MALE: 55-59*Medicaid	2,016	7.30	3,540
MALE: 60-64*Medicaid	1,843	6.90	3,564
MALE: 65-69*Medicaid	2,252	13.73	8,293
MALE: 70-74*Medicaid	2,327	14.92	9,113
MALE: 75-79*Medicaid	2,372	12.88	6,646
MALE: 80-84*Medicaid	2,217	10.34	5,055
MALE: 85-89*Medicaid	2,244	8.26	3,344
MALE: 90-94*Medicaid	1,360	3.38	1,636
MALE: 95+*Medicaid	1,510	2.11	578
FEMALE: 0-34*Medicaid	902	2.45	5,138
FEMALE: 35-44*Medicaid	1,738	7.09	7,634
FEMALE: 45-54*Medicaid	1,733	8.09	8,168
FEMALE: 55-59*Medicaid	2,223	7.98	4,548
FEMALE: 60-64*Medicaid	1,876	7.62	5,454
FEMALE: 65-69*Medicaid	2,320	18.97	16,075
FEMALE: 70-74*Medicaid	2,155	21.05	22,491
FEMALE: 75-79*Medicaid	2,336	21.44	20,055
FEMALE: 80-84*Medicaid	2,268	19.60	18,459
FEMALE: 85-89*Medicaid	1,523	11.42	14,729
FEMALE: 90-94*Medicaid	1,252	6.93	8,903
FEMALE: 95+*Medicaid	506	1.82	4,344
MALE: 65-69*Ever-disabled	2,115	18.04	18,048
MALE: 70-74*Ever-disabled	2,052	16.26	14,559
MALE: 75-79*Ever-disabled	1,694	10.98	9,647
MALE: 80-84*Ever-disabled	1,464	6.74	4,876
MALE: 85-89*Ever-disabled	323	0.69	1,049
MALE: 90-94*Ever-disabled	-7,019	-0.52	1
MALE: 95+*Ever-disabled	--	--	0
FEMALE: 65-69*Ever-disabled	3,084	23.05	13,227
FEMALE: 70-74*Ever-disabled	2,976	21.35	11,432
FEMALE: 75-79*Ever-disabled	2,635	17.15	9,371
FEMALE: 80-84*Ever-disabled	1,812	9.57	6,123
FEMALE: 85-89*Ever-disabled	1,721	4.30	1,351
FEMALE: 90-94*Ever-disabled	--	--	0
FEMALE: 95+*Ever-disabled	--	--	0

Table 8-6 (continued)

PIPDCG Model With Additional Demographic Factors, With Short Stays Excluded

	BASE	
	Model With Full Interactions of Medicaid & Ever Disabled With Age and Sex	
Variable	beta	t-ratio
AGE/SEX GROUPS:		
MALE: 0-34	1,873	7.94
MALE: 35-44	1,939	14.18
MALE: 45-54	2,486	23.30
MALE: 55-59	3,134	22.38
MALE: 60-64	3,874	32.36
MALE: 65-69	2,759	59.13
MALE: 70-74	3,598	89.61
MALE: 75-79	4,625	100.19
MALE: 80-84	5,495	94.48
MALE: 85-89	6,414	75.05
MALE: 90-94	7,019	45.90
MALE: 95+	6,923	21.81
FEMALE: 0-34	1,844	5.86
FEMALE: 35-44	2,055	10.98
FEMALE: 45-54	2,685	17.96
FEMALE: 55-59	3,280	17.86
FEMALE: 60-64	4,544	29.38
FEMALE: 65-69	2,310	56.16
FEMALE: 70-74	2,998	86.59
FEMALE: 75-79	3,810	100.41
FEMALE: 80-84	4,683	105.72
FEMALE: 85-89	5,589	96.97
FEMALE: 90-94	5,928	66.72
FEMALE: 95+	5,754	35.94
PIPDCGs[†]:		
5	1,910	5.68
6	2,333	6.79
7	3,556	10.90
8	4,192	48.52
9	4,666	48.03
10	5,969	51.07
11	6,480	66.10
12	8,474	97.12
14	10,200	59.89
16	12,435	145.85
18	13,547	70.17
20	17,298	89.40
23	19,496	86.56
26	22,313	57.55
29	26,464	64.82

NOTE: Diagnoses from admissions with length-of-stay less than two days are not used in assigning PIPDCGs.

[†] PIPDCG 4 is the omitted category.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 Medicare claims data.

Table 8-7

Rate Cell Factors for the Base PIPDCG Model (Short Stays Excluded)*

I. Demographic Factor (one per person)

		(1) Never Disabled, Non-Medicaid	(2) Ever Disabled, Non-Medicaid	(3) Medicaid, Never Disabled	(4) Medicaid and Ever Disabled
MALE	0-34	n/a	0.36	n/a	0.48
	35-44	n/a	0.37	n/a	0.66
	45-54	n/a	0.48	n/a	0.84
	55-59	n/a	0.60	n/a	0.99
	60-64	n/a	0.75	n/a	1.10
	65-69	0.53	0.94	0.97	1.37
	70-74	0.69	1.09	1.14	1.54
	75-79	0.89	1.22	1.35	1.68
	80-84	1.06	1.34	1.49	1.77
	85-89	1.24	1.30	1.67	1.73
	90-94	1.35	1.42	1.62	1.68
	95+	1.33	1.40	1.63	1.69
FEMALE	0-34	n/a	0.36	n/a	0.53
	35-44	n/a	0.40	n/a	0.73
	45-54	n/a	0.52	n/a	0.85
	55-59	n/a	0.63	n/a	1.06
	60-64	n/a	0.88	n/a	1.24
	65-69	0.45	1.04	0.89	1.49
	70-74	0.58	1.15	0.99	1.57
	75-79	0.73	1.24	1.19	1.69
	80-84	0.90	1.25	1.34	1.69
	85-89	1.08	1.41	1.37	1.70
	90-94	1.14	1.47	1.38	1.72
	95+	1.11	1.44	1.21	1.54

II. PIPDCG Factor (one per person -- add to demographic factor)

PIPDCGs 4	0.00
5	0.37
6	0.45
7	0.69
8	0.81
9	0.90
10	1.15
11	1.25
12	1.63
14	1.97
16	2.40
18	2.61
20	3.34
23	3.76
26	4.30
29	5.10

* From regression model in Table 8-6. Preliminary, subject to actuarial smoothing of regression coefficients

NOTES:
Rate cell denominator: Overall Sample Mean, $5,186
Ever-disabled score for male and female 90-94, 95+ was set to value for age 85-89

OUTPUT DIAG123C OU2

SOURCE Health Economics Research, Inc analysis of 1995 and 1996 Medicare data

9

Model Validation

To this point, the report has been concerned with the development of risk adjustment models and factors. The only goodness of fit statistic that has been consistently presented is the R-squared statistic. The R-squared statistic measures the ability of the model to predict expenditure differences among individuals. It is also important to know how accurately the model predicts mean expenditures for selected groups of Medicare beneficiaries. Ability to predict mean expenditures for groups correctly is measured by the 'predictive ratio', the ratio of mean predicted expenditures to mean actual expenditures.

The first two sections of this chapter analyze how well the PIPDCG payment model predicts mean expenditures for groups of Medicare beneficiaries that are of policy or technical interest. Comparisons are made to the predictive accuracy of demographic models that are similar to the Adjusted Average Per Capita Cost (AAPCC) method on which Medicare risk adjustment is currently based. Section 9.1 discusses predictive accuracy on the 5 percent 1995-1996 Standard Analytic File (SAF) sample. Section 9.2 discusses accuracy using the 1991-1994 Medicare Current Beneficiary Survey (MCBS). The approximately 50 risk groups used to validate the results of the models are defined on demographic characteristics, Medicare entitlement status, dual Medicaid eligibility, expenditure rankings, numbers of hospitalizations, chronic conditions and, in the case of the MCBS, self-reported health and functional status.

Another important property of a risk adjustment model is its stability. That is, for populations of different sizes, such as health plans with different enrollment levels, how stable and predictable are the PIPDCG model's predictions from year to year? The MCBS provides a good opportunity to simulate stability because it is a longitudinal survey with replacement. Like a health plan, there is considerable overlap in its sample across years, but with some turnover. Section 9.3 discusses our stability analysis using statistical reasoning and MCBS simulations.

9.1 Predictive Accuracy Using the Five Percent Sample of Medicare Beneficiaries

Unlike our earlier project (Ellis *et al*., 1996), we did not reserve any of the 1995/1996 SAF sample for model validation. We used the entire 5 percent sample for model development to maximize sample sizes of hospital diagnoses, because hospitalization is infrequent for many diagnoses. Thus, we conduct our group predictive accuracy analysis on the same sample that was used for model development. It is not surprising that the PIPDCG model predicts accurately on this sample for 'validation' groups defined in terms of factors included in the model, such as age and sex. That is what the model was developed to do. However, several of the validation groups that we analyze are not included as predictive variables in the PIPDCG model, and thus provide a true test of the model`s predictive ability. Also, we have found in our earlier work (Pope *et al*., 1998; Ellis *et al*., 1996) that validation results using independent samples reserved for validation, or large random subsamples of the model development sample (e.g., randomly dividing the model development sample into

equal halves), produce similar results to validating on the entire model development sample. This is because all these samples are quite large, minimizing the influence of random small sample variations. We believe that the results presented in this section are representative of results that would be obtained with other large, independent samples of Medicare beneficiaries. Results may differ in small samples, of course, because they are subject to greater random variation.

9.1.1 Predictive Ratios

The predictive accuracy results using the five percent sample of Medicare beneficiaries from 1995 (base year) and 1996 (predictive year) are presented in Tables 9-1 through 9-3. Table 9-1 presents predictive ratios for three risk adjustment models: the age-gender model, a demographic model with age-gender, Medicaid, and 'ever disabled' factors, and the PIPDCG payment model (including age-gender, Medicaid, and 'ever disabled' factors).[1] Medicare's current AAPCC system includes factors similar to the demographic model, except that it excludes 'ever disabled' status, but includes 'institutionalization'.[2] The predictive ratio is calculated as the total predicted payment for a group divided by the actual payment for that group. Values of the predictive ratio close to one indicate better payment accuracy.

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[1] In this chapter, we test the PIPDCG payment model including short stays. The proportion of short stays in our fee-for-service data is small (see Chapter 8), so the predictions of the model including or excluding short stays should be similar in most cases. Also, on this historical fee-for-service dataset, there is no reason to suspect gaming or manipulation of admission rates or lengths of stay to increase payments.

[2] Of course, the AAPCC is not calibrated on the 1995/1996 SAF dataset, so the predictive accuracy of the actual AAPCC payment factors may be somewhat worse than is indicated by our demographic model.

All of the risk adjustment models do well when comparing across subgroups of the population that are defined by age and sex. This is not surprising since age and sex are themselves used for risk adjustment. Adding Medicaid and ever disabled status to age/sex substantially improves predictions for black beneficiaries, but adding hospital diagnoses (the PIPDCGs) results in minimal further improvement. Predicted expenditures remain about 10 percent too low for blacks. Disabled versus aged Medicare entitlement status is captured in all models by age, and is predicted accurately by all models. The expenditures of the 'working aged' are predicted accurately by the second stage multiplier approach (see Chapter 6) used in the demographic and PIPDCG models. Adding Medicaid and ever disabled status in the demographic and PIPDCG models corrects the underpredictions of the age-gender model for these groups.

The PIPDCG model outperforms the age-gender and demographic models for the quintiles of prior expenditures, with the exception of the fourth quintile.[3] It does notably better for the highest-prior-expenditure 20, 5, and 1 percent of Medicare beneficiaries, although still substantially underpredicting for them. The PIPDCG model does a significantly better job of predicting expenditures for individuals ranked according to the number of prior-year hospitalizations, limiting overpayment among individuals with few admissions and underpayment among beneficiaries with two or more hospitalizations.

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[3] Since less than 20 percent of Medicare beneficiaries are hospitalized in a year, the fourth expenditure quintile presumably includes mostly people with large outpatient expenditures. These people are not measured by the PIPDCG model, which includes only hospital diagnoses.

The chronic condition validation groups are defined by ambulatory as well as all inpatient diagnoses. For this reason, they encompass many more beneficiaries than are identified with the diagnosis in the PIPDCG model, which uses only principal inpatient diagnoses. These groups, then, provide a real, (mostly) independent test of the predictive accuracy of the PIPDCG model. While still underpredicting for all chronic disease groups, the diagnostic-based model does better for each diagnosis than the demographic models. The PIPDCG model does best relative to demographics when the diagnosis is most likely to be the reason for a hospital admission, such as for lung/pancreas cancer and intracerebral hemorrhage. Its predictive accuracy exceeds that of the demographic models the least for diagnoses with more outpatient-oriented treatment, such as arthritis or hypertension.

These predictive ratios are very similar to those we obtained with our prior PIPDCG model on a comparable 1991/1992 five percent sample (Ellis *et al.*, 1996, Table 8-3). This shows that the performance of the PIPDCG model is predictable and stable across years and samples, at least for large fee-for-service samples. The predictive performance for groups of the current PIPDCG payment model is slightly worse than of our previous model. We attribute this to the exclusion of many diagnoses from the current, payment-oriented version of the model (see Chapter 3). The PIPDCG model developed in Ellis *et al.*, 1996 included all principal inpatient diagnoses. We feel that the improvement in payment incentives and resistance to provider manipulation and practice pattern variation is worth the slight degradation in predictive accuracy that occurs when diagnoses are excluded.

9.1.2 Predicted Versus Actual Expenditures in Dollars

Table 9-2 compares mean actual expenditures with mean predicted expenditures from each of the three risk adjustment models, by validation group. That is, Table 9-2 shows the denominators and numerators of the predictive ratios of Table 9-1. Large absolute discrepancies between actual and predicted payments that are associated with identifiable patient characteristics create opportunities for biased selection by health plans – either selecting patients whose actual expenditures fall short of predicted expenditures or avoiding individuals whose actual expenditures exceed predicted expenditures. The results, of course, are consistent with the predictive ratios in Table 9-1, but give a better idea of the possible profits and losses in dollars from biased selection.

For example, for the lowest quintile expenditure group, overpayment is reduced from roughly $3,000 under the AAPCC-like model to $2,000 under the PIPDCG model, reducing the incentive to select healthier enrollees. In contrast, for the highest quintile expenditure group, underpayment is reduced from approximately $7,000 under the age and sex model to $3,000 under the diagnosis-based model, weakening the incentives to discourage the enrollment of sicker patients. A similar improvement in incentives can be seen in the hospitalization and chronic condition validation groups. Moving from the age-sex model to the PIPDCG model reduces underpayments from $1,204 to $672 for benign or unspecified hypertension (at the low end) and from $9,874 to $5,747 for lung or pancreas cancer (at the high end).

9.1.3 Predictive Accuracy for Individuals Within Groups: R^2

The second measure of predictive power used to compare across models and validation groups is the R^2 value, shown in Table 9-3. The R^2 measures the proportion of the variance in expenditures across individuals explained by the risk adjustment model. The closer the R^2 value is to 100 percent, the more of the individual-level spending variation is being measured by the model and the stronger the predictive power. The closer the R^2 value is to zero, the less of the cross-sectional spending variation is being captured by the model. For a particular validation group, the R^2 measures ability to predict expenditure variation among individuals in that group. If most of a model's predictive power results from predicting differences in average expenditures across groups, it may have little or no predictive power within a group. In fact, the within-group R^2 can even be negative, if the mean expenditure of a group is a better predicter of individuals' expenditures than the risk adjustment model (see Ellis *et al.*, 1996, Chapter 8 for more details).

The results, shown in Table 9-3, indicate that the PIPDCG model has more predictive power than the demographic models within virtually all risk groups. The diagnosis-based model explains nearly six percent of the spending variation among elderly Medicare enrollees and over nine percent among the disabled, compared with less than two percent under either of the other two models. The PIPDCG model captures significantly more of the cross-sectional variation for the validation groups defined on race, Medicare as secondary payer, ever disabled, and Medicaid enrollee. The PIPDCG model explains over five percent of the variation in spending for beneficiaries with at least one of the listed chronic conditions,

compared with less than one percent for either of the demographic models. None of the models has much predictive power within groups defined on prior-year expenditure quintiles or number of hospitalizations. The large number of negative R^2s indicates that the models' predictive power is across these groups, not within them. But here too the PIPDCG model does relatively better than the demographic models.

9.2 Predictive Accuracy for Groups Using the Medicare Current Beneficiary Survey

We also computed predictive ratios using our 1991-1994 MCBS sample. Results are shown in Table 9-4. Dollar amounts and R^2s were not computed for the MCBS sample. One additional model is validated, a model including age, gender, and hospital diagnoses (PIPDCGs), but excluding Medicaid and ever disabled. Comparing this model with the full payment model including age, gender, Medicaid, ever disabled, and PIPDCGs shows the effect of adding Medicaid and ever disabled to the PIPDCG model.

The MCBS is an independent sample, not used for model development. The coefficients estimated on the 1995/96 5 percent sample were used to predict expenditures for the MCBS sample. The number of observations is about 32,000, but the effective sample size is smaller because the MCBS is a longitudinal survey, and many of the same people respond in multiple years. About 60-70 percent of the respondents are the same across all four years.[4] Because of much smaller sample sizes, the MCBS predictive ratios are not

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[4] The correlation between two years of the expenditures of a person is only about 30 percent, so the effective sample size is only reduced somewhat with the presence of the same people across years.

estimated as precisely as those estimated on the 5 percent sample presented in the previous section. They are not exact amounts, but are subject to random sampling error, which should be kept in mind when interpreting them. The MCBS predictive ratios were normalized to equal 1.00 for the entire sample. Un-normalized ratios are slightly less than 1.00, possibly due to random error (e.g., large expenditure outliers) or differences in the MCBS and 5 percent samples. We normalized so that the underprediction for the entire sample does not affect predictive ratios for individual groups.

The MCBS validation groups are similar to those used in the 5 percent sample analysis in the preceding section. Some groups are collapsed (age/sex) or omitted (working aged) because of the smaller MCBS sample sizes. Three sets of groups are added based on survey variables not available for the 5 percent sample. These are 'institutional status', 'self-rated general health status', and 'functional status'. Also, the MCBS chronic condition groups are defined differently. On the MCBS, respondents were asked if a doctor 'had ever told them that they had [condition]?'. The 5 percent sample chronic condition groups were defined by the presence of a claims diagnosis in the prior year. Thus, in the 5 percent sample analysis, the chronic condition groups include beneficiaries with a condition that is diagnosed and presumably under treatment in the prior year. In the MCBS analysis, the condition is subject to respondent recall, and may have occurred at any time in the respondent's life.

The results (Table 9-4) show that all models predict well for age, gender, and aged/disabled Medicare entitlement status. As expected, models not including Medicaid and ever disabled underpredict for these groups. Models including them slightly overpredict.

This could be due to random error, or an expenditure outlier who is both Medicaid and ever disabled.[5] As found in Chapter 7, expenditures for institutionalized Medicare beneficiaries are predicted accurately by the PIPDCG payment model including Medicaid and ever disabled. Allowing for some random variation in the MCBS predictive ratios, the results across prior-year expenditure and hospitalization groups are similar to the 5 percent sample results, namely, the models including hospital diagnoses (PIPDCGs) do much better than demographic models.

The self-rated general health status and functional status results are particularly interesting, since these validation groups could not be defined on the 5 percent sample. Adding Medicaid and ever disabled, and hospital diagnoses (PIPDCGs) both improve predictive accuracy across these groups, with the PIPDCGs improving accuracy more than the demographic factors. For example, the full payment model with PIPDCGs, Medicaid, and ever disabled raises predicted payments to 67 percent of actual payments for beneficiaries rating their own health as ‘poor’, from a 49 percent ratio for the age-gender model. Adding Medicaid and ever disabled alone increases the predictive ratio from 49 to 54 percent, then adding PIPDCGs raises it to 67 percent. Similarly, the most functionally limited beneficiaries (difficulty in performing 5 to 6 Activities of Daily Living) have an age/sex only predictive ratio of 56 percent. Adding the two demographic factors raises

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[5] For example, compare the ever disabled sample size of 87,154 independent observations in Table 9-1 to the 2,771 non-independent observations in Table 9-4. An expenditure outlier would have a much greater effect on the Table 9-4 than the Table 9-1 results.

predictions to 61 percent of costs, then adding PIPDCGs increases the predictive ratio to 73 percent.

The MCBS chronic condition results are similar to those on the 5 percent sample, with the PIPDCG payment model showing improvement over the full demographic model for every diagnosis except dementia. The margin of improvement is somewhat lower than in the 5 percent sample, as might be expected from the MCBS's broader definition of conditions to include those not currently under treatment. As in the 5 percent sample, the PIPDCG model's margin of superiority is less for diagnoses whose treatment is more outpatient oriented, such as hypertension, skin cancer, and rheumatoid or osteo-arthritis.

9.3 Stability of the PIPDCG Payment Model

An important real-world issue for a risk adjustment model is: how stable are its predictions? It is desirable that predictions for a population that is not changing significantly over time, such as a county's residents or a long-established health plan's enrollees, are stable and predictable over time. The amount of random variation in mean predicted expenditures, or the mean risk score, clearly depends on the size of the population. The incidence of illness is largely random, and in a small population, the number and type of hospitalizations, and hence PIPDCG assignments, may vary from year to year. In this section, we analyze the amount of random variation in the PIPDCG payment model's predictions. In section 9.3.1, we develop a statistical formula to predict the amount of random variation. Then in Section 9.3.2, we conduct a simulation using the Medicare

Current Beneficiary Survey of changes in risk scores nationally and by region across three years.

9.3.1 Statistical Variation in PIPDCG Predictions

In this section, we develop a statistical formula to quantify the amount of random variation in predicted expenditures, or risk scores, from the PIPDCG and demographic risk adjustment models. We then use the formula to estimate the accuracy of mean risk scores for samples of different sizes, such as the enrollees of small and large health plans. Even if PIPDCG predictions are based on a census of plan members, predictions for different years can be thought of as different samples drawn from the plan population. Throughout this section and the next, we focus on quantifying random variation. We assume a stable population whose underlying health risk does not change over time.

To start, we need to establish some notation. Let PE denote predicted expenditures from a risk adjustment model. Assume that PE has mean μ and variance σ^2. Then the sample mean of PE, for example mean predicted expenditures of enrollees in a health plan, is distributed with mean μ and variance σ^2/n. We denote the sample mean of PE for a health plan by $\mu(PE)$. Using the Central Limit Theorem,

$$N = \sqrt{n} \cdot (\mu(PE) - \mu)/\sigma \tag{9-1}$$

is asymptotically distributed as a standard normal random variable with mean 0 and variance 1.

There is a 95 percent chance that a standard normal random variable will lie within the interval (-1.96, 1.96), or a 95 percent chance that

$$-1.96 < N < 1.96. \tag{9-2}$$

Let φ denote national mean predicted expenditures. Multiplying equation (9-2) by σ, $1/\sqrt{n}$, and $1/\varphi$, we have

$$1.96\sigma/(\varphi\sqrt{n}) < \mu(PE)/\varphi - \mu/\varphi < 1.96\sigma/(\varphi\sqrt{n}). \tag{9-3}$$

But $\mu(PE)/\varphi$ is just the sample relative risk score for the health plan, the mean predicted expenditures for its enrollees divided by the national mean predicted expenditures φ. Let's denote 'relative risk score' by $RRS = \mu(PE)/\varphi$. μ/φ is the unknown theoretical value of the relative risk score for the health plan. We estimate it with the observable risk score, RSS. Thus, an estimate of the 95 percent confidence interval for a population's relative risk score is

$$RRS \pm 1.96\sigma/(\varphi\sqrt{n}), \tag{9-4}$$

or, noting that σ/φ is the coefficient of variation, or CV, the 95 percent confidence interval can also be expressed as

$$RRS \pm 1.96 \cdot CV/\sqrt{n}. \tag{9-5}$$

Using equation (9-5), Table 9-5 presents estimated 95 percent confidence intervals for samples of various sizes for three models:

- the age/sex model (model 1 in Table 5-2);
- the demographic model (model 2 in Table 5-2); and
- the PIPDCG payment model, including short stays (model 4 in Table 5-2).

The latter two models include Medicaid and ever disabled status in addition to age and sex. The last model also includes prior year hospital diagnoses. The coefficient of variation for each model was estimated as the national CV on our PIPDCG modelling sample (n = 1.37 million) of its predicted expenditures. The modelling sample CVs are 0.25479 for the age/sex model, 0.34717 for the demographic model, and 0.68295 for the PIPDCG model.[6]

The confidence intervals in Table 9-5 are expressed in percentage points, that is, $(1.96 \cdot CV/\sqrt{n}) \cdot 100$. For example, suppose the mean relative risk score using the age/sex model for a plan with 1,000 enrollees is 1.09. From Table 9-5, the estimated 95 percent confidence interval for this plan's risk score is 1.09 ± 1.6%, or 1.09 ± 0.016, or (1.074, 1.106).

For any sample size, as shown by equation (9-5), the size of the confidence interval of a model is proportional to the CV of that model's predicted expenditures. The demographic model's CV is 40 percent larger than the CV of the age/sex model, and the PIPDCG model's CV is double that of the demographic model, and almost triple that of the age/sex model. The proportional effect of the models' CVs on confidence intervals is clearly evident looking horizontally across Table 9-5 for any sample size. Table 9-5 shows that confidence intervals are large at the smallest sample sizes (50, 100) even for the age/sex model. Confidence intervals rapidly narrow as sample size increases (in proportion to $1/\sqrt{n}$). Confidence intervals of ± 5 percent are reached for the age/sex model at about 100 enrollees, for the demographic model at about 200 enrollees, and for the PIPDCG model at about 750

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[6] From computer outputs BD12C.OUT (age/sex and demographic models), and NEW112BA.OUT (PIPDCG model).

enrollees. Confidence intervals of ± 2 percent are reached for the age/sex model at about 625 enrollees, for the demographic model at about 1,500 enrollees, and for the PIPDCG model at about 4,750 enrollees. Confidence intervals of ± 1 percent are reached for the age/sex model at 2,500 enrollees, for the demographic model at 5,000 enrollees, and for the PIPDCG model at about 17,500 enrollees.

9.3.2 Simulation Using the MCBS of Risk Adjustment Model Stability

In addition to the theoretical formula developed in the preceeding section, we simulate stability of risk model scores over time using actual Medicare (fee-for-service) claims data. The Medicare Current Beneficiary Survey (MCBS) provides a good simulation of a health plan. It is a longitudinal survey, with substantial sample overlap from year to year. But the sample is replenished for attrition and death, simulating turnover in a health plan. The goal is to maintain a representative sample of the national Medicare population each year, implying that the population's medical risk characteristics should be stable over short time periods. Our MCBS sample is for the three pairs of years 1991/92, 1992/93, and 1993/94. Expenditures are predicted for 1992, 1993, and 1994 using prior year characteristics. All computations are weighted to be nationally representative using the MCBS sampling weights.

We computed relative risk scores for 1992, 1993, and 1994 from the same three models studied in the previous section—age/sex, demographic, and PIPDCG. Risk scores were computed for the nation as a whole (entire MCBS sample), and for each of the four

Census regions—Northeast, Northcentral (Midwest), South, and West. Our MCBS sample as a whole has an annual sample size of 10,000 to 11,000, simulating enrollees in a small to moderate size health plan. Regional sample sizes range from about 1,500 to 4,000, simulating enrollees in very small to small health plans. The underlying assumption of the analysis is that actual health status did not vary measurably in the nation as a whole, or in any region, from 1991 to 1994. Hence, differences in risk scores across years for a single model in a given region represent random fluctuations.

Results are shown in Table 9-6. Sample sizes, mean risk scores by model, region, and year, and standard errors of mean risk scores are shown in various panels of the table. As expected, the age/sex model is very stable across years, with only slight variations of 1 percentage point evident in a region's mean age/sex risk scores across the three years. Standard errors of mean regional age/sex risk scores are small, about 0.5 percent. The demographic model is less stable, with variations of as much as 3 percentage points in a region's mean risk score over time. Standard errors for the demographic model are about 0.7 percent. The PIPDCG model is the least stable. Variations of as much as 4 percentage points in a region's risk scores over the three years occur. Standard errors of mean regional risk scores average about 1.4 percent. Still, given that the regions simulate very small health plans, the variations in the PIPDCG's risk scores do not seem unacceptable. They are only slightly greater than fluctuations in the demographic scores, which are roughly representative of HCFA's current AAPCC capitation payment method.

The simulation results are consistent with the theoretical analysis of the previous section, as quantified in Table 9-5. For a normal distribution, doubling the standard error should result in approximately the 95 percent confidence interval factor in Table 9-5, which it does. (Double the standard errors cited in the previous paragraph and compare to the factor for the appropriate model in Table 9-5 for a sample size of 2,500.)

9.4 Conclusions

We conclude that risk adjustment with the PIPDCG model results in consistent and significant improvements in the accuracy of Medicare capitation payments for individuals and many policy relevant groups of beneficiaries as compared to demographic models. This finding replicates across large (such as our 1991/92 and 1995/96 five percent samples) and small (such as our MCBS sample) samples of fee-for-service Medicare beneficiaries. The PIPDCG model offers a clear improvement over Medicare's current demographic risk adjustment for high-cost, chronically ill, and functionally impaired beneficiaries. It predicts their high expenditures more accurately, lessening the financial disincentive for health plans to enroll and provide services to them under capitated payment. But even using the PIPDCG model, expenditures are underpredicted for the highest cost groups. There is room for further improvement in risk adjustment, such as incorporating ambulatory diagnoses.

Payments determined using the PIPDCG risk adjuster are subject to larger random fluctuations than using a demographic risk adjuster. But these fluctuations are not so large as to be a deterrent to use of the PIPDCG model, except, perhaps, for the very smallest health

plans or populations. The stability of PIPDCG predictions over time for defined populations seems acceptable.

Table 9-1

Predictive Ratios[1] for Alternative Risk Adjustment Models, by Validation Subgroup, Five Percent Sample (A predictive ratio closer to 1.00 indicates better prediction)

		Model		
Validation Group	Number of Observations	Age-Gender[2]	Age-Gender + Medicaid and Ever Disabled[3]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[4]
Overall Sample	1,387,105	1.00	1.00	1.00
Age and Gender				
Female, 0-34	7,060	1.00	1.00	1.00
Female, 35-44	13,097	1.00	1.00	1.00
Female, 45-54	16,762	1.00	1.00	1.00
Female, 55-59	10,463	1.00	1.00	1.00
Female, 60-64	13,808	1.00	1.00	1.00
Female, 65-69	138,066	1.00	1.00	1.00
Female, 70-74	195,473	1.00	1.00	1.00
Female, 75-79	165,533	1.00	1.00	1.00
Female, 80-84	125,320	1.00	1.00	1.00
Female, 85-89	77,973	1.00	1.00	1.00
Female, 90-94	35,953	1.00	1.00	1.00
Female, 95+	12,837	1.00	1.00	1.00
Male, 0- 34	11,473	1.00	1.00	1.00
Male, 35-44	21,784	1.00	1.00	1.00
Male, 45-54	25,228	1.00	1.00	1.00
Male, 55-59	13,805	1.00	1.00	1.00
Male, 60-64	17,664	1.00	1.00	1.00
Male, 65-69	112,241	1.00	1.00	1.00
Male, 70-74	145,759	1.00	1.00	1.00
Male, 75-79	110,183	1.00	1.00	1.00
Male, 80-84	69,751	1.00	1.00	1.00
Male, 85-89	33,035	1.00	1.00	1.00
Male, 90-94	11,042	1.00	1.00	1.00
Male, 95+	2,793	1.00	1.00	1.00
Race				
Black	118,843	0.79	0.89	0.90
Non-Black	1,268,262	1.02	1.01	1.01
Medicare Entitlement Status				
Elderly	1,235,960	1.00	1.00	1.00
Disabled	151,145	1.00	1.00	1.00
Other Demographic Characteristics				
Medicare as Secondary Payer[5]	15,461	n/a	0.99	0.99
Ever Disabled	90,792	0.61	0.99	1.00
Medicaid Enrollee, Base Year	205,635	0.70	1.00	1.00
Expenditures, Base Year				
First Quintile (lowest)	277,413	2.66	2.57	2.09
Second Quintile	277,428	1.93	1.88	1.54
Middle Quintile	277,422	1.35	1.35	1.10
Fourth Quintile	277,421	0.95	0.96	0.84
Fifth Quintile (highest)	277,421	0.44	0.47	0.75
Top 5 Percent	69,356	0.27	0.29	0.61
Top 1 Percent	13,872	0.18	0.19	0.47
Hospital Admissions, Base Year				
No admissions	1,127,945	1.32	1.31	1.07
One admission	149,515	0.64	0.66	1.02
Two admissions	62,866	0.48	0.50	0.91
Three or more admissions	46,779	0.28	0.31	0.69

Table 9-1 (continued)

Predictive Ratios[1] for Alternative Risk Adjustment Models, by Validation Subgroup, Five Percent Sample
(A predictive ratio closer to 1.00 indicates better prediction)

		Model		
Validation Group	Number of Observations	Age-Gender[2]	Age-Gender + Medicaid and Ever Disabled[3]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[4]
Chronic Conditions[6]				
Any chronic condition below	958,305	0.83	0.84	0.89
Depression	62,889	0.55	0.59	0.77
Alcohol / Drug Dependence	10,945	0.40	0.44	0.78
Hypertensive Heart / Renal Disease	97,990	0.63	0.65	0.81
Benign / Unspecified Hypertension	558,223	0.82	0.83	0.90
Diabetes with Complications	57,675	0.44	0.47	0.63
Diabetes without Complications	194,852	0.60	0.63	0.73
Heart Failure / Cardiomyopathy	146,059	0.48	0.51	0.74
Acute Myocardial Infarction	26,573	0.45	0.47	0.78
Other Heart Disease	357,088	0.65	0.66	0.80
Chronic Obstructive Pulmonary Disease	234,004	0.60	0.63	0.79
Colorectal Cancer	16,945	0.59	0.59	0.78
Breast Cancer	28,688	0.77	0.75	0.81
Lung/Pancreas Cancer	10,907	0.35	0.35	0.61
Other Stroke	72,018	0.50	0.53	0.74
Intracerebral Hemorrhage	3,676	0.39	0.42	0.73
Hip Fracture	19,384	0.56	0.59	0.83
Arthritis	253,077	0.77	0.79	0.84

[1] Mean predicted expenditures for a group divided by mean actual expenditures.

[2] Model 1 of Table 5-2.

[3] Model 2 of Table 5-2.

[4] Model in Table 8-6. Diagnoses from short stays excluded.

[5] 'Medicare as secondary payer' group was not calculated for Age-Gender model.

[6] 'Defined as persons with a 1995 diagnosis on a Medicare hospital inpatient, outpatient, physician, or other health professional claim.

OUTPUT: BD09A.SRT, DIAG126.OUT, BD12A.OUT, BD12B.OUT, and DIAG127A.SRT.

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 5% SAF.

Table 9-2

Actual Versus Predicted Expenditures for Alternative Risk Adjustment Models, by Validation Subgroup, Five Percent Sample

			Predicted Expenditures		
Validation Group	Number of Observations	Actual Expenditures	Age-Gender[1]	Age-Gender + Medicaid and Ever Disabled[2]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[3]
Overall Sample	1,387,105	$5,186	$5,186	$5,186	$5,186
Age and Gender					
Female, 0-34	7,060	3,697	3,697	3,697	3,697
Female, 35-44	13,097	4,212	4,211	4,211	4,211
Female, 45-54	16,762	4,609	4,608	4,608	4,608
Female, 55-59	10,463	5,482	5,482	5,483	5,483
Female, 60-64	13,808	6,559	6,558	6,558	6,558
Female, 65-69	138,066	3,522	3,522	3,522	3,522
Female, 70-74	195,473	4,129	4,129	4,129	4,129
Female, 75-79	165,533	5,132	5,132	5,132	5,132
Female, 80-84	125,320	6,211	6,211	6,211	6,211
Female, 85-89	77,973	7,209	7,209	7,209	7,209
Female, 90-94	35,953	7,689	7,690	7,690	7,690
Female, 95+	12,837	7,343	7,343	7,343	7,343
Male, 0- 34	11,473	3,410	3,411	3,410	3,410
Male, 35-44	21,784	3,890	3,890	3,890	3,890
Male, 45-54	25,228	4,090	4,089	4,090	4,090
Male, 55-59	13,805	4,782	4,782	4,782	4,782
Male, 60-64	17,664	5,421	5,421	5,421	5,421
Male, 65-69	112,241	4,032	4,032	4,032	4,032
Male, 70-74	145,759	4,771	4,772	4,772	4,772
Male, 75-79	110,183	5,915	5,914	5,915	5,915
Male, 80-84	69,751	7,019	7,018	7,019	7,019
Male, 85-89	33,035	8,075	8,075	8,075	8,075
Male, 90-94	11,042	8,775	8,774	8,774	8,774
Male, 95+	2,793	8,859	8,859	8,859	8,859
Race					
Black	118,843	6,367	5,055	5,688	5,751
Non-Black	1,268,262	5,075	5,198	5,139	5,133
Medicare Entitlement Status					
Elderly	1,235,960	5,259	5,259	5,259	5,259
Disabled	151,145	4,596	4,596	4,596	4,596
Other Demographic Characteristics					
Medicare as Secondary Payer[4]	15,461	1,200	n/a	1,183	1,182
Ever Disabled	90,792	4,804	7,825	7,843	7,894
Medicaid Enrollee, Base Year	205,635	7,332	5,134	7,332	7,332
Expenditures, Base Year					
First Quintile (lowest)	277,413	1,844	4,903	4,741	3,855
Second Quintile	277,428	2,616	5,051	4,927	4,030
Middle Quintile	277,422	3,831	5,188	5,155	4,221
Fourth Quintile	277,421	5,593	5,297	5,345	4,698
Fifth Quintile (highest)	277,421	12,441	5,510	5,796	9,342
Top 5 Percent	69,356	20,105	5,513	5,919	12,253
Top 1 Percent	13,872	30,610	5,370	5,890	14,273
Hospital Admissions, Base Year					
No admissions	1,127,945	3,878	5,127	5,074	4,137
One admission	149,515	8,354	5,355	5,503	8,548
Two admissions	62,866	11,799	5,599	5,881	10,741
Three or more admissions	46,779	19,959	5,610	6,102	13,810

Table 9-2 (continued)

Actual Versus Predicted Expenditures for Alternative Risk Adjustment Models, by Validation Subgroup, Five Percent Sample

			Predicted Expenditures		
Validation Group	Number of Observations	Actual Expenditures	Age-Gender[1]	Age-Gender + Medicaid and Ever Disabled[2]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[3]
Chronic Conditions[5]					
Any chronic condition below	958,305	6,417	5,314	5,380	5,732
Depression	62,889	9,405	5,207	5,518	7,202
Alcohol / Drug Dependence	10,945	11,534	4,555	5,083	8,934
Hypertensive Heart / Renal Disease	97,990	8,558	5,396	5,596	6,899
Benign / Unspecified Hypertension	558,223	6,501	5,297	5,363	5,816
Diabetes with Complications	57,675	11,973	5,215	5,623	7,521
Diabetes without Complications	194,852	8,726	5,213	5,493	6,389
Heart Failure / Cardiomyopathy	146,059	12,256	5,878	6,223	9,006
Acute Myocardial Infarction	26,573	12,161	5,454	5,657	9,511
Other Heart Disease	357,088	8,552	5,557	5,674	6,873
Chronic Obstructive Pulmonary Disease	234,004	8,831	5,291	5,525	6,998
Colorectal Cancer	16,945	9,356	5,516	5,474	7,268
Breast Cancer	28,688	6,520	5,032	4,908	5,272
Lung/Pancreas Cancer	10,907	15,072	5,198	5,274	9,221
Other Stroke	72,018	11,387	5,681	6,018	8,467
Intracerebral Hemorrhage	3,676	14,172	5,590	5,910	10,391
Hip Fracture	19,384	11,098	6,238	6,534	9,182
Arthritis	253,077	7,014	5,429	5,553	5,876

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[1] Model 1 of Table 5-2.

[2] Model 2 of Table 5-2.

[3] Model in Table 8-6. Excludes diagnoses from short stays.

[4] 'Medicare as secondary payer' group was not calculated for Age-Gender model.

[5] Defined as persons with a 1995 diagnosis on a Medicare hospital inpatient, outpatient, physician, or other health professional claim.

OUTPUT: BD09A.SRT, DIAG126.OUT, BD12A.OUT, BD12B.OUT, and DIAG127A.SRT.

SOURCE: Health Economics Research, Inc. Analysis of 1995 and 1996 5% SAF.

Table 9-3

Within-Group Percent of Variance Among Individuals (R^2) Explained by Alternative Risk Adjustment Models, by Validation Subgroup, Five Percent Sample

		Model		
Validation Group	**Number of Observations**	Age-Gender[1]	Age-Gender + Medicaid and Ever Disabled[2]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[3]
Overall Sample	1,387,105	0.87%	1.61%	6.18%
Age and Gender				
Female, 0-34	7,060	0.01	0.32	14.06
Female, 35-44	13,097	-0.01	0.81	11.66
Female, 45-54	16,762	0.00	0.72	9.85
Female, 55-59	10,463	0.00	0.72	8.63
Female, 60-64	13,808	-0.04	0.33	6.70
Female, 65-69	138,066	0.03	1.87	7.27
Female, 70-74	195,473	0.01	1.18	6.37
Female, 75-79	165,533	0.02	0.98	5.84
Female, 80-84	125,320	0.03	0.73	4.70
Female, 85-89	77,973	0.02	0.39	3.93
Female, 90-94	35,953	0.02	0.26	2.67
Female, 95+	12,837	-0.01	0.08	2.83
Male, 0- 34	11,473	0.01	0.20	12.28
Male, 35-44	21,784	0.00	0.68	11.99
Male, 45-54	25,228	0.00	0.58	7.24
Male, 55-59	13,805	0.00	0.57	8.08
Male, 60-64	17,664	-0.02	0.38	6.59
Male, 65-69	112,241	0.00	1.08	5.48
Male, 70-74	145,759	0.01	0.64	4.44
Male, 75-79	110,183	0.02	0.41	3.68
Male, 80-84	69,751	0.02	0.36	4.10
Male, 85-89	33,035	0.02	0.31	3.88
Male, 90-94	11,042	0.04	0.21	3.70
Male, 95+	2,793	0.00	0.18	2.63
Race				
Black	118,843	0.27	1.40	7.12
Non-Black	1,268,262	0.89	1.57	5.94
Medicare Entitlement Status				
Elderly	1,235,960	0.91	1.68	5.79
Disabled	151,145	0.36	0.90	9.02
Other Demographic Characteristics				
Medicare as Secondary Payer[4]	15,461	n/a	1.41	2.67
Ever Disabled	90,792	-2.68	0.48	5.93
Medicaid Enrollee, Base Year	205,635	-0.94	1.04	7.35
Expenditures, Base Year				
First Quintile (lowest)	277,413	-14.38	-13.91	-6.31
Second Quintile	277,428	-7.56	-7.57	-2.50
Middle Quintile	277,422	-1.19	-1.49	0.34
Fourth Quintile	277,421	0.29	0.36	-1.60
Fifth Quintile (highest)	277,421	-8.87	-7.43	0.00
Top 5 Percent	69,356	-21.44	-19.50	-3.48
Top 1 Percent	13,872	-38.07	-35.85	-12.95
Hospital Admissions, Base Year				
No admissions	1,127,945	-0.29	0.01	1.25
One admission	149,515	-2.37	-1.51	-0.45
Two admissions	62,866	-8.18	-6.77	1.32
Three or more admissions	46,779	-23.03	-20.93	-0.12

Table 9-3 (continued)

Within-Group Percent of Variance Among Individuals (R^2) Explained by Alternative Risk Adjustment Models, by Validation Subgroup, Five Percent Sample

		Model		
Validation Group	**Number of Observations**	Age-Gender[1]	Age-Gender + Medicaid and Ever Disabled[2]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[3]
Chronic Conditions[5]				
Any chronic condition below	958,305	0.08	0.87	5.45
Depression	62,889	-4.61	-3.13	7.28
Alcohol / Drug Dependence	10,945	-9.45	-7.51	4.80
Hypertensive Heart / Renal Disease	97,990	-2.13	-0.87	6.47
Benign / Unspecified Hypertension	558,223	0.02	0.97	6.21
Diabetes with Complications	57,675	-8.52	-6.66	3.00
Diabetes without Complications	194,852	-2.95	-1.61	5.15
Heart Failure / Cardiomyopathy	146,059	-7.42	-6.12	2.06
Acute Myocardial Infarction	26,573	-5.88	-4.87	2.95
Other Heart Disease	357,088	-2.22	-1.23	4.68
Chronic Obstructive Pulmonary Disease	234,004	-2.72	-1.46	5.67
Colorectal Cancer	16,945	-3.47	-2.98	3.50
Breast Cancer	28,688	-0.47	0.23	5.45
Lung/Pancreas Cancer	10,907	-10.37	-9.84	-0.38
Other Stroke	72,018	-6.42	-5.08	2.69
Intracerebral Hemorrhage	3,676	-7.90	-7.00	1.63
Hip Fracture	19,384	-5.92	-4.86	2.08
Arthritis	253,077	-0.41	0.64	5.68

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[1] Model 1 of Table 5-2.

[2] Model 2 of Table 5-2.

[3] Model in Table 8-6. Excludes diagnoses from short stays.

[4] 'Medicare as secondary payer' group was not calculated for Age-Gender model.

[5] Defined as persons with a 1995 diagnosis on a Medicare hospital inpatient, outpatient, physician, or other health professional claim.

NOTE:
The statistics in the table are percent of expenditure variation among individuals in a subgroup explained by a model. The R^2 is negative if the mean expenditures of a group are a better predictor of the expenditures of individuals in the group than the predictions of the risk adjustment model.

OUTPUT: BD09A.SRT, DIAG126.OUT, BD12A.OUT, BD12B OUT, and DIAG127A.SRT

SOURCE: Health Economics Research, Inc. analysis of 1995 and 1996 5% SAF.

Table 9-4

Predictive Ratios[1] for Alternative Risk Adjustment Models, by Validation Subgroup, Medicare Current Beneficiary Survey (A predictive ratio closer to 1.00 indicates better prediction)

		Model			
Validation Group	Number of Observations[2]	Age-Gender[3]	Age-Gender + Medicaid and Ever Disabled[4]	Age-Gender + PIPDCG[5]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[6]
Overall Sample (unnormalized)	32,021	0.97	0.98	0.95	0.96
Overall Sample (normalized)[7]	32,021	1.00	1.00	1.00	1.00
Age					
0-64	2,978	1.01	0.97	1.00	0.97
65-74	15,742	0.98	0.97	0.98	0.98
75-84	10,068	1.02	1.02	1.02	1.02
85+	3,232	1.02	1.02	1.02	1.02
Gender					
Female	18,848	1.00	1.00	1.00	1.00
Male	13,173	1.00	0.99	1.01	1.00
Medicare Entitlement Status					
Elderly	28,995	1.00	1.00	1.00	1.00
Disabled	3,026	1.00	0.98	0.99	0.97
Ever Disabled	2,771	0.70	*1.14*	0.77	*1.11*
Medicaid Status, Base Year					
Medicaid	4,062	0.75	*1.07*	0.82	*1.06*
No Medicaid	27,959	1.05	*0.98*	1.04	*0.99*
Institutional Status, Prediction Year					
Non-institutionalized	30,086	1.07	1.06	1.06	1.05
Institutionalized	1,935	0.75	0.88	0.89	0.98
Expenditures, Base Year					
First Quintile (lowest)	6,506	2.28	2.18	1.89	1.83
Second Quintile	6,717	1.80	1.77	1.49	1.47
Third Quintile	6,590	1.28	1.27	1.05	1.06
Fourth Quintile	6,396	0.89	0.89	0.77	0.78
Fifth Quintile (highest)	5,811	0.47	0.49	0.79	0.80
Top 5 percent	1,407	0.31	0.33	0.71	0.70
Hospital Admissions, Base Year					
no admissions	26,564	1.26	1.23	1.03	1.03
one admission	3,738	0.68	0.70	1.07	1.07
two or more admissions	1,718	0.35	0.37	0.79	0.79
Self-Rated General Health Status					
Poor	2,876	0.49	0.54	0.63	0.67
Fair	6,452	0.76	0.81	0.83	0.86
Good	9,648	1.04	1.03	1.02	1.01
Very Good	7,870	1.42	1.36	1.32	1.27
Excellent	5,174	1.86	1.74	1.65	1.57
Functional Status. Difficulty in:					
5-6 Activities of Daily Living	2,128	0.56	0.61	0.69	0.74
3-4 Activities of Daily Living	2,584	0.65	0.69	0.73	0.76
1-2 Activities of Daily Living	7,016	0.80	0.83	0.83	0.85
None	20,293	1.38	1.33	1.29	1.26
Elderly helped with 3+ ADLs[8]	2,262	0.57	0.64	0.72	0.77
Chronic Conditions[9]					
Arteriosclerosis	4,695	0.73	0.77	0.81	0.83
Heart Attack	4,570	0.63	0.65	0.75	0.76
Angina	4,662	0.66	0.68	0.76	0.78
Other Heart Conditions	8,538	0.74	0.76	0.83	0.84
Hypertension	16,086	0.90	0.90	0.92	0.93
Stroke	3,445	0.69	0.73	0.81	0.83

Table 9-4 (continued)

Predictive Ratios[1] for Alternative Risk Adjustment Models, by Validation Subgroup, Medicare Current Beneficiary Survey

(A predictive ratio closer to 1.00 indicates better prediction)

		Model			
Validation Group	Number of Observations[2]	Age-Gender[3]	Age-Gender + Medicaid and Ever Disabled[4]	Age-Gender + PIPDCG[5]	Age-Gender + PIPDCG + Medicaid and Ever Disabled[6]
Chronic Conditions (continued)					
High Cost Cancer	1,056	0.74	0.76	0.84	0.85
Low Cost Cancer	4,936	0.88	0.86	0.91	0.90
Skin Cancer	4,676	0.98	0.95	0.98	0.96
Diabetes	4,916	0.63	0.66	0.72	0.74
Rheumatoid Arthritis	3,968	0.77	0.81	0.80	0.83
Osteoarthritis	16,260	0.93	0.94	0.94	0.95
Osteoporosis	2,825	0.80	0.82	0.85	0.86
Mental Retardation	733	1.16	1.33	1.12	1.24
Dementia	1,181	0.91	0.99	1.01	1.07
Mental Disorders	2,153	0.80	0.88	0.86	0.92
Hip Fracture	1,492	0.86	0.91	0.96	1.00
Parkinson's Disease	549	0.70	0.73	0.76	0.78
Chronic Obstructive Pulmonary Disease	4,339	0.69	0.71	0.78	0.80
Partial Paralysis	2,519	0.68	0.71	0.78	0.81
Amputation of arm/leg	389	0.51	0.58	0.63	0.68
Lost urine more than once per week	4,141	0.66	0.71	0.74	0.77
Computer Output:	MCBS21BB.OUT	MCBS21b.OUT	VALID01C	MCBS28A.OUT	MCBS28A.OUT

NOTES:

Italics are used to indicate that the validation group is defined by variables included in the predictive model.

[1] Predictive ratios are subject to sampling error, and are not exact numbers. Generally, predictive ratios for subgroups with larger numbers of observations are estimated more precisely.

[2] Weighted by MCBS sampling weights and fraction of the year alive. The MCBS is a longitudinal sample; the same person is often included for multiple years. The number of observations exceeds the number of sample persons.

[3] Model 1 of Table 5-2.

[4] Model 2 of Table 5-2.

[5] Model 2 of Table 8-5. Excludes diagnoses from short stays.

[6] Model in Table 8-6. Excludes diagnoses from short stays.

[7] Predictive ratios were normalized by dividing them by the predictive ratio of the overall sample.

[8] ADL is activity of daily living.

[9] Persons who reported that a doctor had ever told them they had the condition are included in group.

SOURCE: Health Economics Research, Inc. analysis of 1991-1994 Medicare Current Beneficiary Survey data.

Table 9-5

Ninety Five Percent (95%) Confidence Intervals for Relative Risk Scores (Percentage Points, Plus or Minus Mean Risk Score for a Population)

	Model					
	Age-Sex[1]		Demographic[2]		PIPDCG[3]	
Coefficient of Variation*100	25.479		34.717		68.295	
Sample Size						
50	±	7.1%	±	9.6%	±	18.9%
100	±	5.0	±	6.8	±	13.4
250	±	3.2	±	4.3	±	8.5
500	±	2.2	±	3.0	±	6.0
750	±	1.8	±	2.5	±	4.9
1,000	±	1.6	±	2.2	±	4.2
1,500	±	1.3	±	1.8	±	3.5
2,500	±	1.0	±	1.4	±	2.7
5,000	±	0.7	±	1.0	±	1.9
7,500	±	0.6	±	0.8	±	1.5
10,000	±	0.5	±	0.7	±	1.3
15,000	±	0.4	±	0.6	±	1.1
20,000	±	0.4	±	0.5	±	0.9
25,000	±	0.3	±	0.4	±	0.8
50,000	±	0.2	±	0.3	±	0.6
75,000	±	0.2	±	0.2	±	0.5
100,000	±	0.2	±	0.2	±	0.4
250,000	±	0.1	±	0.1	±	0.3
500,000	±	0.1	±	0.1	±	0.2
1,000,000	±	0.0	±	0.1	±	0.1
5,000,000	±	0.0	±	0.0	±	0.1
10,000,000	±	0.0	±	0.0	±	0.0

[1] Model 1 of Table 5-2.
[2] Model 2 of Table 5-2.
[3] Model 4 of Table 5-2.

NOTE:
Calculated as 1.96*(CV/SQRT(Sample Size)). For example, if the mean age-sex risk score for a health plan with 1,000 enrollees is 1.05, the 95% confidence interval is (1.034, 1.066).

OUTPUT (CV): BD12C.OUT and NEW112BA.OUT

SOURCE: Health Economics Research, Inc. of 1995/1996 Medicare data.

Table 9-6

Stability Analysis: Mean Risk Scores by Region, 1992-94, Medicare Current Beneficiary Survey

Region	All Years	1992	1993	1994
I. Sample Size				
US	32,021	10,812	10,466	10,743
Northeast	7,194	2,467	2,332	2,395
North central	8,268	2,726	2,712	2,829
South	11,685	3,915	3,819	3,951
West	4,874	1,704	1,602	1,567
II. Mean Risk Scores				
Age/Sex Model				
US	0.970	0.970	0.970	0.970
Northeast	0.970	0.970	0.970	0.980
North central	0.980	0.980	0.980	0.980
South	0.970	0.970	0.960	0.970
West	0.970	0.970	0.970	0.980
Demographic Model				
US	0.980	0.970	0.970	0.990
Northeast	0.960	0.950	0.950	0.970
North central	0.960	0.960	0.950	0.960
South	0.990	0.990	0.990	1.000
West	1.000	1.000	0.990	1.020
PIPDCG Payment Model				
US	1.000	1.000	0.990	1.010
Northeast	1.010	1.020	1.000	1.030
North central	0.980	0.970	0.970	0.990
South	1.010	1.010	0.990	1.020
West	1.000	0.980	0.990	1.020
III. Standard Errors of Mean Risk Scores				
Age/Sex Model				
US	0.001	0.002	0.002	0.002
Northeast	0.003	0.005	0.005	0.005
North central	0.003	0.005	0.005	0.005
South	0.002	0.004	0.004	0.004
West	0.004	0.006	0.006	0.006
Demographic Model				
US	0.002	0.003	0.003	0.003
Northeast	0.004	0.007	0.007	0.007
North central	0.004	0.007	0.007	0.006
South	0.003	0.006	0.006	0.006
West	0.005	0.009	0.009	0.010
PIPDCG Payment Model				
US	0.004	0.006	0.006	0.007
Northeast	0.008	0.014	0.014	0.014
North central	0.007	0.012	0.012	0.012
South	0.006	0.011	0.010	0.011
West	0.009	0.016	0.016	0.017

OUTPUT: MCBS26B.OUT

SOURCE: Health Economics Research, Inc. analysis of 1991-1994 Medicare Current Beneficiary Survey data.

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APPENDIX 3

“45 Day Notice”

January 15, 1999

HCFA Beneficiaries Plans & Providers States Researchers Students
Medicare Medicaid CHIP Customer Service FAQs Search

Medicare+Choice Rates -- 45 Day Notice

Cover Memorandum

Preliminary Estimate of the Increase in the National Per Capita Growth Percentage for 2000

Changes in Methodology Since 1999 Rates: Risk Adjustment

- A. Background
- B. The Principal Inpatient Diagnostic Cost Group (PIP-DCG) Model
  - 1. From Diagnosis Groups (DxGroups) to PIP-DCGs
  - 2. Modifications to the PIP-DCG Model
  - 3. Addition of Demographic and Other Factors
  - 4. The Current PIP-DCG Model
  - 5. Technical refinements to the calibrated model
- C. Proposed Payment System Application of the PIP-DCG Model
  - 1. Estimating Beneficiary Relative Risk Factors
  - 2. Risk Adjusted Payment Model
  - 3. Calculation of the Rescaling Factor
  - 4. Transition Policy
  - 5. Other implementation issues
- D. Summary of HCFA's Proposed Approach for 2000

Table 1: Diagnoses (DxGroups) Included in Each PIP-DCG -- Payment Model

Table 2: Payment Model -- Beneficiaries Medicare Eligible at Least One Year

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Data files and programs

- PIPPROGS.EXE (25K bytes) is a self-extracting ZIP file of the PIPDCG payment model software which expands into 4 files.
  - PIPPROGS.DOC -- Documentation
  - PIPMODEL.TXT -- SAS Program Code
  - FMTPROG.TXT -- SAS Program Code
  - FMTXWALK.TXT -- DATA
- ICD-DCG.EXE (59K bytes) is a self-extracting ZIP file of the ICD and DCG crosswalks which expands into 2 comma delimited files. The fields are separated by commas and text strings are enclosed in double quotes ("). The extracted files are ready to be imported into spreadsheets.
  - ICD2DCG.TXT -- Crosswalk sorted by ICD codes
  - DCG2ICD.TXT -- Crosswalk sorted by DCG codes
- AVGRISK.EXE (45K bytes) is a self-extracting ZIP file of the estimated average county risk factors. Minor revisions are possible prior to the annual announcement of payment rates on March 1, 1999. The fields are separated by commas and text strings are enclosed in double quotes ("). The extracted file is ready to be imported into spreadsheets.

Medicare+Choice Rates -- 45 Day Notice

January 15, 1999

NOTE TO: Medicare+Choice Organizations and Other Interested Parties

SUBJECT: Advance Notice of Methodological Changes for the CY 2000 Medicare+Choice Payment Rates

In accordance with Section 1853(b)(2) of the Social Security Act, we are required to notify you of the proposed changes to be made in the Medicare+Choice capitation rate book methodology for 2000. Please find enclosed the methodology changes for 2000 and a preliminary estimate of the increase in the national per capita Medicare+Choice growth percentage for aged Medicare beneficiaries. This advance notice includes a detailed description of the new risk adjustment methodology which will be in effect for 2000, and information on how risk adjustment will be implemented, including an explanation of the transition method that will be employed. Briefly, the approach HCFA will use to meet the year 2000 mandate for risk adjusted payments will:

(1) Be based on inpatient data;
(2) Apply individual enrollee risk scores in determining fully capitated payments;
(3) Utilize a prospective PIP-DCG risk adjuster to estimate relative beneficiary risk scores;
(4) Apply separate demographic-only factors to new Medicare enrollees for whom no diagnostic history is available;
(5) Apply a rescaling factor to address inconsistencies between demographic factors in the rate book and the new risk adjusters;
(6) Use 6 month old diagnostic data to assign PIP-DCG categories (the "time shift" model, as opposed to using the most recent data and making retroactive adjustments of payment rates part way through the year);
(7) Allow for a reconciliation after the payment year to account for late submissions of encounter data;
(8) Phase-in the effects on risk adjustment, beginning with a blend of 90 percent of the demographically adjusted payment rate, and 10 percent of the risk-adjusted payment rate in the first year (CY 2000); and
(9) Implement processes to collect encounter data on additional services, and move to a full risk adjustment model as soon as is feasible.

Comments or questions may be addressed to:

Mr. James Hart
Health Care Financing Administration
C4-25-02
7500 Security Boulevard
Baltimore, Maryland 21244

In order to receive consideration prior to the March 1, 1999 announcement of Medicare+Choice capitation rates, comments must be received by February 15, 1999.

Barbara S. Cooper
Director
Office of Strategic Planning

Robert A. Berenson, M.D.
Director
Center for Health Plans and Providers

Solomon Mussey, A.S.A.
Director
Medicare and Medicaid Cost Estimates Group
Office of the Actuary

Medicare+Choice Rates -- 45 Day Notice

Preliminary Estimate of the Increase in the National Per Capita Growth Percentage for 2000

The Balanced Budget Act of 1997 changed the payment methodology for determining payments to managed care plans. The new payment methodology is based on increases in the national per capita Medicare+Choice growth percentage as defined in Section 1853(c)(6). The current estimate of the increase in the national per capita Medicare+Choice growth percentage for aged enrollees in 2000 is 5.2 percent under present law. This estimate reflects an underlying trend increase in per capita costs of 5.8 percent, an adjustment of -0.5 percent (as required by section 1853(c)(6)(B)), and an adjustment for the fact that the current estimate of prior years aged Medicare+Choice growth percentage is 0.1 percent lower than the estimate actually used in calculating the 1999 rate book (as required by section 1853(c)(6)(C)). The preliminary estimate of the floor for aged beneficiaries in 2000 is $399.59, which represents a 5.2 percent increase over the 1999 floor of $379.84. This rate of increase for the floor includes for the first time an adjustment for the fact that the current estimate of prior years aged Medicare+Choice growth percentage is 0.1 percent lower than the estimate actually used in calculating the 1999 rate book (as required by section 1853(c)(6)(C)).

These estimates are preliminary and could change before the final rates are announced on March 1, 1999. Further details on the derivation of the national per capita Medicare+Choice growth percentage will also be presented in the March 1 announcement.

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Medicare+Choice Rates -- 45 Day Notice

Changes in Methodology Since 1999 Rates: Risk Adjustment

A. Background

Since 1985, Medicare payments to risk contracting Health Maintenance Organizations (HMOs) for aged and disabled beneficiaries have been based on actuarial estimates of the per capita cost Medicare incurs paying claims on a fee-for-service (FFS) basis in a beneficiary's county of residence. (Medicare's costs in paying claims for beneficiaries with end-stage renal disease are not considered in these county estimates, but are treated separately on a statewide basis.) These county estimates have been adjusted for the demographic composition of that county (age, gender, Medicaid eligibility status, working aged status, and institutional status) in order to produce a figure representing the costs that would be incurred by Medicare on behalf of an average Medicare beneficiary living in that county. These county per capita payment rates, adjusted for the average beneficiary, have been published annually as the county rate book. Prior to January 1998, monthly payments to HMOs for each enrollee were based on this county rate book amount, adjusted for the enrollee's demographic factors. This methodology is known as the "Adjusted Average Per Capita Cost" (AAPCC) methodology, and HMOs with Medicare contracts under section 1876 of the Social Security Act (the Act) were paid on this basis between 1985 and 1997.

In enacting the new Part C of Title XVIII to create the Medicare+Choice program, the Congress provided, in a new section 1853 of the Act, for a new methodology for paying organizations that enter into Medicare+Choice (M+C) contracts. Under this new methodology, the equivalent of the above-described county rate book (that is, the county-wide amount that is adjusted by an individual enrollee's demographic status to determine the final payment amount) is based on the greatest of three amounts. The first amount is a new blended payment rate methodology that would combine local and national rates in setting county rates. The second amount is a new minimum specified rate amount (for example, $367 per month per enrollee in 1998). The third amount is based on a 2 percent increase over the prior year's rates, with the rate book for 1997 serving as the baseline. As in the case of the AAPCC methodology described above, monthly payments are the county rates under section 1853 of the Act, adjusted for the demographic status of each enrollee. Under section 1876(k)(3) of the Act, the new Medicare+Choice payment methodology under section 1853 of the Act applies to existing HMO contracts under section 1876 for 1998. This methodology continues to apply to these same organizations in 1999 to the extent that they have entered into Medicare+Choice contracts.

Section 1853(a)(3) of the Act requires the Secretary to develop and implement a new risk adjustment methodology to be used to adjust the county-wide rates under section 1853 of the Act to reflect the expected relative health status of each enrollee. This new methodology, which must be implemented by January 1, 2000, will replace the current method of adjusting county-wide rates based only demographic factors of age, gender,Medicaid eligibility, working aged status, and institutional status. The goal is to pay Medicare+Choice organizations based on better estimates of their enrollees' health care utilization relative to the fee-for-service (FFS) population.

While the Medicare+Choice legislation mandates the implementation of risk adjustment in general, the legislation provides the Secretary with broad discretion to develop a risk adjustment methodology that would "account for variations in per capita costs based on health status and other demographic factors." The Medicare+Choice legislation (section 1853(a)(3)(B) of the Balanced Budget Act) allowed for the collection of data other than inpatient hospital data only on or after July 1, 1998. This provision envisioned that a hospital-only system would be implemented initially, both because it seemed more feasible for plans to produce inpatient data only in the short term, and because the effect of a hospital-only system on payments would be smaller than a system based on comprehensive encounter data. (The Medicare+Choice regulations further provided that we would collect physician, outpatient hospital, SNF, or HHA data no earlier than October 1, 1999. See 42 CFR 422.257(b)(2)(i).) In previous public meetings on encounter data requirements, organizations have been briefed on the Principal Inpatient Diagnostic Cost Group (PIP-DCG) risk assessment model, created by HHS-sponsored researchers at Health Economics Research, Inc., Boston and Brandeis Universities, and the Harvard School of Medicine. The model has been updated using 1995 and 1996 Medicare data, and refined to exclude selected diagnoses and one day hospital stays. A preliminary risk adjustment methodology was published in theSeptember 8, 1998 *Federal Register*. We received 34 letters commenting on the preliminary methodology. The remainder of this advance notice outlines our approach for implementation of risk adjusted payments on January 1, 2000, discussing both the risk adjustment methodology and the proposed risk adjustment payment model. This notice reflects several changes to the methodology in response to comments on the preliminary methodology.

In the development of all risk adjustment payment models, there are two tasks that must be performed: (1) the estimation of the risk adjustment model, and (2) application of the risk adjustment model to a payment system. The estimation of the PIP-DCG model is described first.

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B. The Principal Inpatient Diagnostic Cost Group (PIP-DCG) Model

In constructing a risk adjustment model, it is important to determine which set of conditions should be used to adjust payments. Under the current AAPCC payment system, all enrollees are placed in a base group paid according to demographic characteristics. In the PIP-DCG risk adjustment system, hospitalizations are used as markers for a particularly ill and high cost subset of beneficiaries for whom higher payments will be made in the next year. However, the costs associated with beneficiaries who have been hospitalized for conditions used in the PIP-DCG system are no longer in the base payment category. Payments for people in the base payment category decrease as payments are increased for beneficiaries identified as high cost.

Because an inpatient hospital-based system depends on data from just one site of service, only a subset of conditions should be recognized for increased payments. That is, the system should recognize admissions for which inpatient care is most frequently appropriate and which are predictive of higher future costs. For example, admissions for diseases most commonly treated on an outpatient basis should remain in the base group and should not be used for upwards adjustment, since inclusion of these admissions would provide an inappropriate incentive for hospitalization.

The PIP-DCG model was estimated using diagnostic information for Medicare FFS enrollees from inpatient hospital stays during calendar year 1995, and Medicare costs in the following year. The sample used in the estimation analyses consisted of individuals included in the 5-percent sample of Medicare beneficiaries who were alive and enrolled in Medicare during all of 1995, and on January 1, 1996. Beneficiaries with certain characteristics (for example, HMO enrollees, end-stage renal disease enrollees, and new Medicare eligibles in 1996) were excluded from the analyses. In general, these exclusions were made to increase confidence that a complete set of Medicare claims for each beneficiary in the sample data set was included in the model development. The final estimation data set included approximately 1.4 million Medicare beneficiaries.

While the PIP-DCG model uses only inpatient diagnoses in creating the risk adjustment classification system, the model *predicts total expected costs* for the following year across multiple sites of services. Consequently, all Medicare expenditures, other than those for hospice care, were included in the calculation. Medicare expenditures forhospice care were not included because Medicare+Choice organizations are not responsible for hospice care. The model was estimated assuming no time lag between the base year (diagnostic information) and the predicted expenditures; that is, calendar year 1995 beneficiary diagnoses were used to predict calendar year 1996 expenditures.

1. From Diagnosis Groups (DxGroups) to PIP-DCGs

Diagnostic classification: The risk adjustment model estimation process begins with a classification system, forming the inherent logic of the model. For the PIP-DCG model, principal inpatient diagnoses are classified into diagnosis groups (DxGroups). The DxGroups comprise an exhaustive classification of all valid International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) diagnostic codes. The primary criteria in forming the DxGroups were clinical coherence and an adequate sample size to estimate average expenditures. Beneficiaries with multiple different inpatient diagnoses could have multiple hospital stays, and would potentially be assigned multiple DxGroups.

Creation of PIP-DCG groups: Next, DxGroups were aggregated into payment groups, or PIP-DCGs, using a sorting algorithm that ranked DxGroups based on 1996 actual expenditures. Highest expenditure DxGroups were grouped into the "highest" PIP-DCG. Once beneficiaries with the highest costs were placed into a DxGroup, those beneficiaries and all their associated expenditures were removed from the data for other DxGroups and then the DxGroups were re-ranked. The DxGroups with the next most costly diagnoses were grouped into the next highest numbered PIP-DCG, and thosebeneficiaries were removed from the remaining DxGroups. The process was repeated until each beneficiary and his or her expenditures were assigned to a single PIP-DCG group. Beneficiaries with multiple inpatient diagnoses were placed in their highest expenditure PIP-DCG group.

In this way, each PIP-DCG group was defined according to average total expenditures for beneficiaries with inpatient diagnoses, which were first categorized, grouped, and sorted using the DxGroups. Based upon this sorting algorithm, more than 20 initial PIP-DCGs were defined. Lower average expenditure PIP-DCG groups had lower cost ranges (or intervals), while the highest average expenditure PIP-DCG groups had wider ranges.[1]

2. Modifications to the PIP-DCG Model

Admissions not selected for higher payment: After the initial sorting of DxGroups into PIP-DCG groups was complete, a clinical panel reviewed the placement of the DxGroups and their resulting predicted expenditures, to determine the appropriateness of their application in a payment model. Through this process, 75 DxGroups (covering about 1/3 of the admissions) were identified as: (1) representing only a

minor or transitory disease or disorder, not clinically likely to result in significant future medical costs, (2) rarely the main cause of an inpatient stay, or (3) vague or ambiguous. These groups, as recommended by the clinical panel, were identified as those most likely to result in inconsistent or inappropriate reimbursements and were placed (with their associated expenditures) in the base payment category (for which the payment is a function ofdemographic factors). Examples of these groups include the DxGroup for fluid/electrolyte disorders and malnutrition. Though the treatment for individuals with this diagnoses is often quite costly in the following year, the diagnosis is clinically vague and, therefore, represented a likely target for coding "creep." The clinical panel concluded that many of the sickest individuals with this diagnosis were likely to have another more specific hospitalization that would trigger appropriate increased reimbursements. Then, the remaining DxGroups were resorted and placed into revised DCGs for the payment model. A total of 15 PIP-DCGs (above the base payment category) are included in the final payment model. Costs for persons with excluded admissions, as well as no admissions, are included in the demographically-based payment amounts, as they are under the current Average Adjusted Per Capita Cost (AAPCC) system.

Short stays: As a second strategy to ensure consistent and appropriate payment levels, beneficiary diagnoses reported as a result of a short hospital stay (1 day or less) were left in the base payment category. Since the majority of 1-day stays are for diagnoses already assigned to the base group, the effect on payment is small. Also, short stays are often indicative of less serious, and, hence, less costly cases. It is important to note that these modifications do not mean that these expenditures have been excluded from the model. Rather, the payments associated with these diseases are captured in increased payments for the base payment category.

Industry concerns: We received a number of comments (based on the September 8, 1998 *Federal Register* notice) regarding this decision to "exclude" 1 day stays from the final PIP-DCG groups. Related comments expressed managed care industry concern that a risk adjustment model based only on inpatient diagnoses, particularly one which further excludes short stays, would disadvantage some plans and not provide "credit" for management on an outpatient basis. In response, we must stress that the purpose of the PIP-DCG model is to serve as an interim step towards implementation of a comprehensive risk adjustment model (i.e., one which uses diagnoses from all sites of service). The current AAPCC model makes no adjustments for level of illness, chronic or otherwise. The goal of the PIP-DCG model is to offer a significant improvement over the current system by identifying a relatively small group of high cost, serious illnesses, and provide a marginal additional payment appropriate for these seriously ill beneficiaries.

Another rationale for the exclusion of one day stays was to limit possible "gaming" of the new payment system. Plans that might convert treatment of some diseases from outpatient to one day admissions, increase the frequency of short "observational" stays, and otherwise increase the use of short hospital admissions for marginal diagnoses, would trigger potentially large increases in payments for relatively low cost (the costs associated with a one day hospital stay). To further refine the model as a method of identifying the sickest individuals, and to discourage the potential payoff for gaming, we excluded one day stays of any diagnoses for the purpose of triggering increase PIP-DCG payments.

We placed in the base payment category all vague, non-predictive, and/or marginal diagnoses, as well as diagnoses resulting from 1 day stays. As a result, only a subgroup of seriously ill beneficiaries is identified for increased payments. In restricting the adjustment to a small proportion of beneficiaries, the system makes a smaller change to the current demographic-only system than would be made by a system that takes into account all patient encounters. This attribute of the PIP-DCG system, however, makes it an ideal starting point for implementation of risk adjustment. It is important to recognize that, on average, payments for all beneficiaries remaining in the base category (88 percent of all beneficiaries) are based on demographics, as in the current system. To the extent that Medicare+Choice organizations have had favorable selection when payment is based on demographics, we will continue to overpay for this group. However, this overpayment would be reduced.

In regard to plans' concern about the bias in the PIP-DCG system against outpatient management of chronic illnesses and higher incidence of short stays, we agree that a comprehensive model is preferable, and we plan to move toward implementing such a model as expeditiously as possible. However, implementation of the comprehensive risk adjustment model is not operationally feasible for 3 to 4 years, because of data constraints on both plans and HCFA. In the interim, the PIP-DCG model offers a substantial improvement over the current system.

Diagnostic exceptions: Under the final payment PIP-DCG model, beneficiaries who are hospitalized for chemotherapy (ICD-9 codes V58.1 and V66.2) are treated asexceptions. These codes are indicators of a treatment method, rather than a particular disease. Recognizing, however, that Medicare's current inpatient coding rules require that the diagnoses for beneficiaries who are hospitalized for chemotherapy must be coded using these V-codes as the principal diagnoses, the most appropriate PIP-DCG group for these beneficiaries would be assigned based on the type of cancer, using a secondary diagnosis. In addition, the final payment model also treats individuals diagnosed with AIDS as an exception. In this case, individuals with a secondary diagnosis of AIDS will be placed in the same PIP-DCG group as individuals with a reported principal diagnosis of AIDS. The rationale for this decision is HCFA's analysis showed that individuals with a secondary diagnosis of AIDS tended to have expenditures close to those admitted explicitly for the treatment of AIDS.

The final mapping of the DxGroups to the PIP-DCG groups is shown in Table 1

3. Addition of Demographic and Other Factors

Age and Sex: Twenty-four age/sex cells were included that mirror the splits currently used in Medicare's current demographic adjustment methodology. For the purposes of calibrating the model, beneficiaries are assigned to more than one age cell if they aged into a new cell during 1996. For example, a beneficiary aged 69 on January 1, 1996 but who turned 70 years old later in 1996, is assigned to both the 65-69 and the 70-74 age cells as a fraction of eligible months in each cell. The value of the age/sex variable is the fraction of 12 months the

person is in that cell. Payments for all monthsare thus set to the weighted average of the two payments and no change is necessary in the birthday month.

In the development of the final payment model, we also considered the inclusion of other demographic variables. The purpose of including other demographic independent variables was to take into consideration the unique cost implications of characteristics not related to admissions, and to increase the accuracy of the payment estimates for suogroups of the Medicare population. The additional independent variables considered for inclusion were:

- Originally disabled;
- Medicaid status;
- Institutional status; and
- Working aged.

Originally disabled: A beneficiary is defined as originally disabled if he is currently entitled to Medicare as an aged beneficiary, but was originally entitled by reason of disability. The other variables are currently used in Medicare's demographic adjustment methodology, although not necessarily in the way proposed here.

Preliminary analyses showed that Medicare expenditures for beneficiaries who were originally disabled or Medicaid enrolled were substantially higher than predicted by age, sex, and principal hospital diagnoses. Data on these characteristics for beneficiaries are available in HCFA administrative files. Analyses showed that if these factors were not taken into consideration in the calibration, the model would not predict the average expenditures of several important, and higher-cost, Medicare subgroups.

In the demographic model currently used by Medicare, originally disabled is not a risk factor. Rather, a separate rate book has applied to the currently disabled population. However, we reasoned that the originally disabled may have higher Medicare expenditures than those who were not "originally disabled" (i.e., the elderly who were never entitled by reason of disability). Versions of the PIP-DCG model which did not include factors accounting for original reason for entitlement exhibited a predicted payment reduction when a disabled 64 year-old became classified as aged at age 65.

In the payment model, the originally-disabled variable is added interactively with the age/sex cell variable. This means that for a given age/sex cell, predicted costs vary between those who were originally disabled and those who were not originally disabled. Alternatively, it allows for the possibility that the trajectory of expected costs as beneficiaries age could differ between the originally disabled and those not originally disabled.

Medicaid eligibility: Currently, Medicaid status is a concurrent adjustment factor for Medicare capitation payments. That is, a Medicare beneficiary is placed into an AAPCC "rate cell" payment category each month based on his or her current Medicaid enrollment status. For the purposes of risk adjustment, we defined Medicaid status as enrollment in Medicaid in any single month during the diagnosis year (e.g., all or part of 1995). Thus, in the risk adjustment system, beneficiaries who are Medicaid-eligible at any time during the data collection year will be eligible for the Medicaid payment increment for the entire payment year; payments will no longer vary according to month-to-month Medicaid eligibility in the payment year. This variable is also included interactively with the age/sex cell variable.

Institutional status: Another independent variable considered for inclusion was institutional status. We received a number of comments regarding the inclusion of an institutional adjustment; because of this level of interest, our analysis of the issue will be presented in some detail. Institutional status is currently used in the AAPCC methodology as a concurrent risk adjuster. For each prior month in a certified institution, a beneficiary is paid at the higher institution rate cell amount the following month. It is included as a marker for higher expected concurrent cost. The concern expressed by the commenters is that we will be underpaying for these beneficiaries if we do not make a similar concurrent adjustment in the new system.

In analyzing this issue for the purpose of risk adjustment, we also defined institutional status concurrently, as the fraction of the prediction year institutionalized, i.e., the number of institutional months in the prediction year divided by the number of Medicare eligible months. Because it is very difficult to identify long-term institutional care in claims data, the effect of institutional status was estimated using three concatenated years of the Medicare Current Beneficiary Survey (MCBS), from 1992 to 1994.

There is great variation in Medicare costs for institutionalized beneficiaries across types of institutions. Certified institutions under HCFA's definition include both post-acute and long-term care facilities. Post-acute care facilities include Skilled NursingFacilities (SNFs). Long-term care facilities include nursing homes, mental health facilities, and Intermediate Care Facilities for the Mentally Retarded (ICF/MRs). Three quarters of the institutionalized are in nursing homes. Half of the remainder are in SNFs or the SNF/nursing home combination. About 7 percent are in ICF/MRs, and 3 percent are in mental health facilities.

Our analysis using MCBS data showed that the PIP-DCG model accurately predicts the average costs of the entire group of institutionalized beneficiaries. This suggests that there is no need for an institutional factor. However, our analysis also showed that mean actual Medicare payments for those in post-acute care facilities are far greater than those for long-term care facilities. In Medicare, a SNF stay requires a preceding hospital stay. The payment system is designed to pay premiums that are correct on the average for groups of enrollees. It does not pay based on actual events in the payment year. If we did so, we would also recoup payments for those who incur very low costs in the payment year. Thus we do not pay more for the particular group that spend some time in a SNF. While those in long term care facilities

incur more costs than average Medicare beneficiaries, they incur less costs than predicted by the PIP-DCG model. An institutional factor for this population would actually be negative if implemented. The incentives for identifying the long term institutionalized and reporting on this group are low when the result is a payment reduction. We have therefore decided not to pay based on this site of service. There are relatively few enrollees in this group and the overpayments will be small.

Given these considerations, we have decided not to include an institutional status factor in the payment model.

4. The Current PIP-DCG Model

To estimate the final coefficients of the PIP-DCG calibration model, HCFA regressed annualized 1996 expenditures on the 15 PIP-DCGs, age/sex groups, originally disabled status, and Medicaid status. The model is specified so that there is a separate variable for each age/sex group. To this there is an additional vector of age/sex variables for those who were originally disabled, and a vector of age/sex variables for those who were Medicaid enrollees. The final PIP-DCG payment model is shown in Table 2.

The regression yields payment estimates based upon fee for service data. It is important to note that these payments are not the payments that will be made to the M+C plans. Payment under the Medicare system will be based upon county rates (as published in the Medicare+Choice rate book) as mandated by BBA. These payment amounts estimated here will be converted into relative risk factors, which in turn modify the appropriate county rate according to the characteristics of the individual Medicare+Choice enrollee. The following discussion pertaining to predicted payments is, therefore, for purposes of illustration.

Increased payments for PIP-DCG categories: The coefficients for PIP-DCGS 5 through 29 show the *marginal* expenditure/payment for a person with a 1995 principal in-patient diagnosis placing them in that PIP-DCG (see Table 2). For example, a 73 year old woman with a single 1995 admission for `Precerebral Arterial Occlusion' is in PIP-DCG8, implying an annualized 1996 payment of $2,998 (age/sex coefficient) + $4,192 (PIP-DCG 8 coefficient) = $7,190.

Higher numbered PIP-DCG yield higher payments. Altogether, persons in PIP-DCGS 5 through 29 comprise approximately 12 percent of the sample, and 68 percent of sample persons hospitalized in 1995. In other words, the payment PIP-DCG model uses principal hospital diagnoses to risk adjust payments for about 12 percent of all Medicare beneficiaries; the other 88 percent are risk adjusted only by age, sex, and other demographics, much as they are under the current system. Of those hospitalized, 68 percent receive increases in payments in the following year.

Medical education: For the purposes of estimating the final payment factors, it would have been ideal to exclude all Graduate Medical Education (GME) payments (i.e., both indirect and direct medical payments) to hospitals from the 1996 expenditure amounts, but it was not possible to do so. The BBA specifies that GME amounts are to be "carved out" of capitation payments to M+C plans (over a period of 5 years, with full carve out achieved in 2002), and paid directly to teaching hospitals. Through a relatively simple algorithm, it was possible to remove the indirect medical payments, which reflect approximately two thirds of total GME payments. Though a portion on GME therefore remained in the costs used for model calibration, there is little effect on payments. It is important to note that the PIP-DCG model is used to compute relative factors only. GME payments will be removed from the rate book amounts in accordance with the requirements of the BBA.

Decedents: To correctly estimate monthly payments for all beneficiaries, including people who died or entered a hospice during 1996, we used a process of weighting by Medicare eligible months in the prediction year. First, annualized 1996 payments were calculated as actual total 1996 payments divided by the fraction of the year each beneficiary is alive or not enrolled in a hospice. This yielded an average monthly cost. Annualized payments were then defined as 12 times the average monthly cost. These annualized payments were then weighted by the fraction of the year the beneficiary was eligible for Medicare. This process avoids the dilution of costs typically associated with decedents in their last months of life. The process of annualizing and weighting observations resulted in unbiased estimates of the average and total payments for a group in which individuals are eligible for different fractions of the year.

Data collection and time lags: The final payment model was calibrated assuming no time lag between the data collection period (using diagnoses collected between January 1, 1995 through December 31, 1995) and the predicted payment year (beginning January 1, 1996) While this approach results in model coefficients with the maximum predictive accuracy, it also introduced difficult operational issues; under this approach, retroactive payment adjustments would be necessary because encounter records would still be flowing in for some months of the payment year.

An alternative approach proposed in the September 8, 1998 *Federal Register* notice, called the "time shifted" model, uses data from an earlier period (for example, July 1, 1998 through June 30, 1999) to determine the risk factor for enrollees andpayments to Medicare+Choice organizations for calendar year 2000. However, calibration of the model continues to assume no data lag. Using data from an earlier time period introduces some error into the estimates, but we do not believe it introduces any systematic bias. Assuming a relatively large and stable population for a plan, aggregate payments under this approach are not likely to differ from aggregate payments using a method requiring retroactive payment adjustment. On an individual basis, using data from an earlier time period lengthens the time between a hospital stay for an enrollee and compensation to the organization based on the stay, but also continues the higher payment beyond the time it would be paid in a non-shifted system.

In the September 8, 1998 *Federal Register* notice, HCFA asked existing risk contractors for comments on: (1) problems Medicare+Choice

organizations might encounter with retroactive payment adjustments, and (2) problems organizations might encounter, if data from an earlier time period were used. Comments received on the *Federal Register* notice almost unanimously favored the time shifted model. The commenters specifically mentioned the following reasons for preferring this model:

- Both plans and their providers would find it easier to understand and administer financial interactions if individual risk scores were known before the start of the contract year.
- Retroactive adjustments would increase payment uncertainty for M+C organizations. In particular, M+C organizations would not know their final per enrollee payments for a year until several months after the ACR for the followingyear was filed. In addition, providers with percentage-of-premium contracts could experience mid- year adjustments that could require changes to reimbursements for individual providers.
- Implementation of retroactive adjustments would also require additional changes to HCFA's payment systems which would not be required under the alternative. Such changes would not be easy to accomplish in the current implementation schedule.

We agree with the commenters who recommended that we not adopt the retroactive model at this time. We are persuaded that the increased administrative burdens and greater uncertainty about payment levels render this option unacceptable for the present. Moreover, we do not believe that implementation of this option, using the current PIP-DCG model, would create any systematic bias at the level of the aggregate payment to a plan.

5. Technical refinements to the calibrated model

Before we turned this estimated model into a payment system, a number of technical refinements were incorporated, including the development of factors for two sub-populations not addressed in the calibration of the model: the working aged and the newly entitled.

Working Aged Adjustment: The PIP-DCG model was calibrated using Medicare beneficiaries not covered by employer or other group policies. For beneficiaries with employer insurance, Medicare is the secondary payor and its liability is much smaller thanfor those who are not working. Using administrative data, it is estimated that, on the average, Medicare's liability for the working-aged is 21 percent of the liability for those for whom Medicare is the primary payer. Therefore, payments made to beneficiaries in this status were reduced to 21 percent of what they would have been.

Demographic-only factors for new enrollees: As described earlier, the model was calibrated using only beneficiaries for whom Medicare data existed in 1995 and 1996. One implication of this model is that it requires diagnoses in the year before payment is made. Therefore, the model cannot predict expenditures for beneficiaries for whom Medicare does not have diagnosis data. The Medicare program cannot compile diagnosis data on beneficiaries for the year before they enter the program. Thus, no prior diagnosis information exists for the new disabled beneficiaries and age-in beneficiaries. Predicted expected cost estimates were derived for these beneficiaries using only demographic factors.

Two similar, but different methods were used to predict expenditure estimates for the age-ins in the 65-69 age groups and other new eligibles. Those age 70 and above, and those under 65, were assigned the mean predicted expenditure for beneficiaries in the same age/sex/Medicaid status cell. For the age-ins between age 65 and 69, a different procedure was used because the mean predicted value for the age bracket was based mainly on persons 67-69 years old in 1996. Actual expenditures in 1996 for persons 67-74 years old were computed and used in a regression to predict the missing age groups. For all new enrollees, payments based on Medicaid eligibility will be made retroactively, once enrollment can be established and verified.

Actuarial graduation of the final payment model factors: HCFA's Office of the Actuary revised the age/sex demographic coefficients. Upon review, the age/sex coefficients for the originally disabled, and Medicaid recipients were found to be somewhat irregular in pattern. This pattern, if uncorrected, would have led to irregular changes in payments as beneficiaries in these groups aged. Therefore, these coefficients were refined by HCFA actuaries so that the predicted payment patterns across age groups within each of those categories was smoothed. Several generally accepted actuarial techniques were used to smooth each set of factors. The actuarial techniques used were graduation, regression, interpolation, and judgement. The type of graduation used was Whittaker-Henderson which smoothed the raw payment amounts using a minimization formula based on a linear combination of fit versus smoothness. The fit part of the expression is the summation of the squared differences between the raw data and the smoothed data. The smoothness part of the expression is the summation of squared third differences which approximates a quadratic function. Each of the fit and smoothness component of the formula is minimized simultaneously. Also, the graduation uses weights for each age group and the weights represent the number of Medicare beneficiaries in each cell.

Further detail on the PIP-DCG payment model: Two additional sources of information are available on the final PIP-DCG payment model. Located on HCFA'sexternal Web sit (http://www.hcfa.gov/stats/hmorates/aapccpg.htm) are: (1) basic SAS software for the PIP-DCG grouper, and (2) a detailed text file of the mapping of ICD-9-CM codes to DxGroups, and finally to PIP-DCGs. These files are made available for information purposes, but are subject to minor modifications prior to the annual announcement of payment rates to be issued on March 1, 1999. Also, no technical support is available from HCFA for organizations who decide to utilize the SAS version of the PIP-DCG grouper.

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[1] The PIP-DCG groupings were further refined using a number of criteria. First, each original PIP-DCG group retained its identity in the

final payment model only if it contained at least 1,000 beneficiaries in the original sample; this minimum sample size was defined to assure stability of estimated payments in the model. If sample sizes were smaller than 1,000, the potential PIP-DCG was expanded to include DxGroups with average expenditures in the next lower range until the sample size was satisfied. If at any time during the sorting algorithm a DxGroup had fewer than 50 beneficiaries assigned to it, it was assigned to the base payment category. This base payment category also included all beneficiaries (and expenditures) for whom there was no Inpatient diagnosis during 1995.

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C. Proposed Payment System Application of the PIP-DCG Model

In its basic form, the PIP-DCG model is an algorithm that uses base year inpatient diagnoses, along with demographic factors, to predict total health spending in thefollowing year. In applying the PIP-DCG model to risk adjust payments for the Medicare+Choice program, however, the model will be used to determine relative risk factors. To derive the relative risk factors, predicted expenditure estimates from the model are divided by the mean predicted expenditures for FFS beneficiaries. Currently, we estimate this mean to be $5,100, though final refinements to this figure are possible prior to the annual announcement of payment rates on March 1, 1999. Because the predicted expenditures are used in the form of relative ratios, applied to the rate book, payments are not sensitive to the year of the expenditure data used in the calibration. These relative risk factors will be used, in place of the current demographic factors, to adjust county rate book amounts for the relative health status of the individual enrollee.

1. Estimating Beneficiary Relative Risk Factors

The PIP-DCG model was developed to be "additive", meaning that incremental dollars are added based on beneficiary characteristics. Referring to Table 2, the following examples illustrate how the PIP-DCG model will be used for estimating relative risk factors.

Examples: In this example, Beneficiary A was hospitalized twice during the base year. The diagnoses reported were Asthma (PIP-DCG 8) and Staphylococcus Pneumonia (PIP-DCG 18). The highest PIP-DCG category then for this beneficiary is PIP-DCG 18, which carries with it an estimated future year expenditure of $13,547. The beneficiary is also placed in the appropriate demographic group. In this case, Beneficiary A is male, aged 82. This age group carries an estimated expenditure of $5,495. In addition,Beneficiary A had originally been Medicare eligible because of a disability (which carries an incremental expenditure of $1,462), but is not eligible for Medicaid (no expenditure increment). Adding together these increments based on the PIP-DCG model, the predicted expenditures for this beneficiary are $20,504.

Beneficiary B had no inpatient admissions during the base year. Therefore, no specific PIP-DCG increment is added; expenditures for non-hospitalized beneficiaries are included in the demographic factors. Beneficiary B is placed in the appropriate age and sex grouping; in this case, female, aged 69, which carries a predicted expenditure of $2,310. Beneficiary B is also placed in the Aged with Medicaid eligibility group, which adds $2,207 to her annual predicted expenditures. Since she has never been disabled, no additional expenditures are added. Therefore, total annual predicted expenditures for Beneficiary B are $4,517.

Because Medicare+Choice program payments are based on the county-wide rates determined under section 1853(c) of the Act, the predicted annual expenditures described above will be converted to relative risk factors. This is accomplished by dividing the predicted expenditures for each beneficiary by the national average predicted expenditure (currently estimated at $5,100). Individuals whose risk factors are equal to 1.00 are "average." In the examples described above, Beneficiary A's relative risk factor is 4.02 (indicating a high expected cost individual), while Beneficiary B's relative risk factor is 0.89 (indicating a slightly lower than average risk individual). The risk factors for new enrollees would be determined in the same manner, though separate age/sex andMedicaid factors derived for these beneficiaries are used. (See the section on *Demographic-only factors for new enrollees* above.)

Assignment of risk factors: After Medicare+Choice organizations submit inpatient hospital encounter data for the payment year, we will use the demographic information and diagnostic information from all Medicare+Choice organizations a beneficiary may have joined and from FFS to determine the appropriate risk factor for each beneficiary. It is at this point that information regarding beneficiary Medicaid eligibility (in any single month during the diagnosis data collection year), original reason for Medicare entitlement (originally disabled) for any one month, identification as a new enrollee, beneficiary age, sex and working-aged status (beneficiary covered under a employer insurance) are determined using Medicare administrative data files, and are used along with inpatient diagnostic data to assign the appropriate risk factor

When a Medicare+Choice organization forwards beneficiary enrollment information to HCFA, we, in turn, will send the organization the appropriate risk factor for the beneficiary, as well as the resultant payment. Because the risk factor is *computed for each individual beneficiary for a given year,* the factor follows that beneficiary. In addition, since all beneficiaries will have risk factors, information will be immediately available for payment purposes as beneficiaries move among Medicare+Choice organizations.

2. Risk Adjusted Payment Model

To determine risk adjusted monthly payment amounts for each Medicare+Choice enrollee, individual risk factors (described above) will be multiplied by the appropriate payment rate for the county determined under section 1853 of the Act. To make this calculation appropriately, an adjustment to these rate book amounts will be required before applying the risk adjustment factors discussed above. This adjustment, or rescaling factor, is necessary in order to account for the fact that the existing county rate book is already scaled to the set of demographic

factors used under the current system, but not to the risk factors we will be using under the new system. If the PIP-DCG model risk adjustment factors were applied to unadjusted county rate book amounts, this would create inaccurate payments inconsistent with Congress' mandate in section 1853 of the Act.

The application of the rescaling factor in effect translates the rate book amounts into the same language used under the risk adjustment methodology. As a result of rescaling, payment using the risk-based rate book for a person with the average risk factor in a county would be the same as payment for a person with the average demographic factor in that county using the original demographic-based rate book. (However, a person with the average demographic factor does not necessarily have the average risk factor.) To the extent that an organization enrolls sicker people, the organization will receive higher payments. By itself, the rescaling process is payment neutral (which is not the same as budget neutrality). That is, the apparent effects of the rescaling factor on the resulting county rates is exactly offset by the estimated effects of moving fromdemographic to risk factor standardization in assignment of individual enrollee factors. By itself, rescaling does not raise or lower payments. Whether aggregate payments to a plan increase or decrease depends upon the risk profile of the beneficiaries enrolled in the plan.

3. Calculation of the Rescaling Factor

The essential purpose of the implementation of risk adjustment is the *substitution* of individual enrollee demographic factors with a new individual enrollee risk adjustment methodology. But this substitution should take place in *two* places: in the standardization of county rates, and in the method of estimating relative risk of individual enrollees. BBA modifications to the rate book make a direct rate book standardization substitution difficult because the 1997 demographic AAPCC rates are the basis for future rate books.

Demographic standardization: The old (demographically-based) AAPCC rate book represented the cost to Medicare in a given county for the national average beneficiary measured demographically. County rates were calculated by dividing county per capita costs by county average demographic factors. Prior to BBA, these rates were updated annually. However, because of BBA modifications, all Medicare+Choice county rates have their basis in the 1997 AAPCC Rate Book. Thus, the factors used in calculating this 1997 Rate Book are "locked in" - including the average county demographic factors. Also, the 2 percent minimum increase must be based on the prior year's rates.

Risk factor standardization: Despite these policy complications, it is important to apply the new enrollee risk adjustment methods to an appropriately standardized rate book. This is the case because, if we were to shift from an enrollee *demographic* factor to *risk-based* adjustments, while maintaining the factors underlying the current rate book, a critical inconsistency would be created in the overall payment methodology. The risk adjustment methodology adds disease information to purely demographic information. Though attempting to measure the same thing -- relative health status -- the range of factors for the demographic-only and risk factors differs. This is in part simply because the measurement range (or "ruler") of risk factors exceeds that of the old demographic-only factors, and because the new risk factors are able to distinguish differences in health status more accurately. However, because the "rulers" differ between demographic and risk factors, a technical modification is necessary for payments to remain methodologically correct. Without some adjustment, this inconsistency between the standardization factors used in the county rates and the enrollee risk factors will result haphazardly in either significant underpayments or overpayments, depending on the county.

Example: The best way to illustrate the problem is through the following hypothetical example. Assume that, under the old AAPCC methodology, the average county demographic factor for county A was 1.0, indicating that, based on demographic factors, Medicare beneficiaries in "A" were at the national average. However, under the new risk adjustment methodology to be implemented under BBA, the average risk factorfor county "A" is 1.3, indicating under this new measurement system that "A" county Medicare beneficiaries are "sicker" than the national average. In both cases, the same population is being measured during the same year - it's just that the "rulers" are different.

This difference in rulers -- left uncorrected -- would result in erroneous payments in the following way. Consider a Medicare beneficiary living in county "A" who has a number of health problems, but whose risk factor is the same as the county average (1.3). Without any correction, the risk adjusted payment system will pay 1.3 times the rate book amount. Assuming monthly per capita costs in county A were $600, the demographic rate book amount would be $600 divided by 1.0 (the average demographic factor in county A), or $600. In other words, under the current system, beneficiaries with demographic factors equal to the county average would be paid $600. Payments under risk adjustment, however, would be 1.3 times $600, or $780.

If the rate book were recomputed according to the average risk factor in the county (1.3), the rate would be $600 divided by 1.3, or $462. Payment for this average individual would then be $462 times 1.3, or $600. This is the correct amount for the average person in county A.

Potential underpayment for some beneficiaries would also occur in the absence of rescaling. For example, assume that the average county demographic factor in hypothetical county "B" is 1.1, or just slightly above the national average. Assume as well that the average county risk factor is estimated at 0.9, indicating a slightly healthierthan average beneficiary population compared to the national average. For a Medicare beneficiary residing in county "B," who is equal to the county average of 0.9, a significant underpayment would result. Assuming per capita costs of $500, the demographic rate book would be $500 divided by 1.1, or $455. Risk adjusted payment for the average person would be .9 times $455, or $410. This is significantly less than the $500 that would be appropriate for the average person in county "B." If the rate book were appropriately rescaled, the rate book amount would be $500 divided by .9, or $556. A beneficiary with the average county risk factor of .9 would therefore receive a risk adjusted payment of .9 times $556, or $500.

Use of a rescaling factor: The most direct and accurate way to fix this problem would be to calculate both the average county and individual enrollee factors on the same scale - as originally done when both were calculated using demographic factors. Unfortunately, this is not possible since the rate book (including the demographic basis for the average county factor) is set by law. However, a "county rescaling factor," which is part of the risk adjustment methodology, places both the county and enrollee factors back on a comparable scale. The rescaling factor for each county will be defined as the ratio of the following:

County Rescaling Factor = (Risk County Rate) / (Demographic County Rate)

The denominator of this ratio (the demographic county rate) is simply the county rate calculated under the current system. The numerator (risk county rate) is the county rate properly standardized to the new risk adjustment factors. The calculation of these restandardized rates, resulting in risk-based county rates, require a number of steps. The process described here is somewhat simplified, though it provide sufficient understanding for the purpose of explaining the county rescaling factor.

Method for calculating county rescaling factors: First, average county risk factors (using the payment PIP-DCG model, and computed for each county for years 1994, 1995 and 1996, based on 100 percent Medicare FFS data) were developed. The average county risk factors replace the average county demographic factors found in the AAPCC rate book. The average county risk scores were calculated from the 1994, 1995, and 1996 data, except for counties with small numbers of Medicare beneficiaries where adjustments were made. HCFA's Office of the Actuary (OACT) calculated combined Aged, Disabled, Parts A and B per capita costs for 1997. These combined county costs were standardized by the average county risk factors, making new local restandardized rates. From these new local rates, OACT applied the mandated calculations (e.g. blends/floors,/2 percent increase, budget neutrality, medical education carve outs, etc), consistent with BBA requirements. This process will be used to create a risk rate book, which could be used (in the numerator in the rescaling factor) to determine payments beginning in 2000.[2]

There will technically be two rescaling factors for each county: one to rescale payments for aged enrollees, and the other for disabled enrollees. For example, in a given county, the rescaling factor used in payments for an aged beneficiary is defined as:

(Risk County Rate) / (Aged Demographic County Rate)

For disabled beneficiaries, the ratio is:

(Risk County Rate) / (Disabled Demographic County Rate)

What differs in each case is only the denominator. Additional information on average county risk factors is available at HCFA's Web site (http://www.hcfa.gov/stats/hmorates/aapccpg.htm). A file containing estimated county risk factors for the purpose of creating a 1997 risk rate book is posted on the Web site. However, minor revisions to the average county risk factors are possible prior to the annual announcement of payment rates on March 1, 1999.

Payment system application: Risk adjusted payment amounts for enrollees will thus be calculated as follows:

Payment = Demographic County Rate * [(Risk County Rate)/(Demographic County Rate)] * Enrollee Risk Factor

Although it is cumbersome, this approach preserves BBA requirements while assuring that payments are a function of the enrollee risk factor and the appropriately scaled risk rate book. Preserving the demographic rate book also facilitates implementation of a transition payment system that phases in the new system in stages.

4. Transition Policy

Many commenters on the *Federal Register* notice recommended that HCFA either delay implementation of risk adjustment, or provide for a transition period as part of our risk adjustment methodology. The commenters requesting delay were especially concerned about basing initial risk adjustment on inpatient hospital data only (the PIP-DCG model), which would not reflect conditions normally treated in ambulatory settings and which could encourage unnecessary hospitalizations. Those advocating a transition expressed concern about the potential for large fluctuations in payments to organizations as a result of implementing risk adjustment. These commenters mentioned either risk corridors or a blend methodology as possible transition strategies.

We do not believe that it would be desirable to delay implementation of risk adjustment. Even if we believed that delaying risk adjustment were desirable, however, the agency does not have the authority to do so. The Balanced Budget Act specifically requires "implementation of a risk adjustment methodology... no later than January 1, 2000." In order to meet that deadline, we are constrained to employ a model based on hospital encounter data alone in the interim until the data to implement a comprehensive risk adjustment methodology can be provided by all plans and processed by HCFA. However, the statute grants us broad authority to develop a risk adjustment methodology, and does not prohibit us from including a transition or "phase-in" period as a component of the methodology we develop. In cases in which Congress has specified a change in methodology by statute, rather than granting HCFA the authority to develop the methodology, Congress

has included a transition period as a component of themethodology spelled out in the statute (e.g., the physician fee schedule). In other cases, we have built a transition period into regulations providing for payment changes where Congress did not specify a methodology in detail (e.g., the prospective payment system for hospital capital-related costs). In this case, a transition period would not only insure against abrupt swings in payment rates, but could permit HCFA to incorporate non-inpatient encounter data before the maximum impact of risk adjustment takes effect.

We have decided to include a transition period as a component of our risk adjustment methodology, initially using a blend of payment amounts under the current demographic system and the PIP-DCG risk adjustment methodology. Under a blend, payment amounts for each enrollee would be separately determined using the demographic and risk methodologies (i.e., taking the separate demographic and risk rate books and applying the demographic and risk adjustments, respectively). Those payments amounts would then be blended according to the percentages for the transition year.

We have decided to adopt the blend methodology without risk corridors for a number of reasons. One reason is that a blend methodology is both familiar from several previous transitions (e.g., both operating and capital PPS) and easily comprehensible. It also provides the most straightforward manner of proceeding from payment based fully on demographic adjustments to full risk-adjusted payment.

We believe that a blend methodology alone more effectively promotes the goals of risk adjustment during the transition period. To varying degrees, any transition methodwould weaken the goal of paying more appropriately for the health status of beneficiaries and encouraging plans to engage in less risk selection. Under the blend transition method, there is no full risk adjustment for any enrollee until the end of the transition period. Thus, a blend provides lower payment for enrolling sicker beneficiaries than there would be under full risk adjustment. However, organizations would still receive additional payment proportionate to the blend percentage for enrolling sicker beneficiaries. We believe that the blend method can provide adequate safeguards against abrupt changes, in particular by providing initially for a low blend percentage of the risk-adjusted payment rate. We have therefore decided that the first year blend percentages will be 90 percent of the demographically adjusted rates, and 10 percent of the risk-adjusted payment rate. We have also decided to implement a five-year transition, which will culminate in full implementation of comprehensive risk adjustment, using all encounter data, in the fifth year. Specifically, we have decided upon the following transition schedule:

CY 2000 90 percent demographic method 10 percent PIP-DCG method
CY 2001 70 percent demographic method 30 percent PIP-DCG method
CY 2002 45 percent demographic method 55 percent PIP-DCG method
CY 2003 20 percent demographic method 80 percent PIP-DCG method
CY 2004 100 percent comprehensive risk adjustment (using full encounter data)

In order to implement comprehensive risk adjustment in CY 2004, we will soon be providing plans with guidance concerning requirements for submission of outpatient, physician, and other non-inpatient encounter data.

Our preliminary analyses of the first year's impact of risk adjustment indicate that these blend percentages should significantly reduce the initial impact to organizations of risk adjustment. Specifically, these analyses suggest that the decrease in aggregate payments to M+C organizations under this transition from risk adjustment alone will be less than 1 percent in the first transition year. While the impact on specific organizations will vary, this preliminary analysis also suggests that the maximum decrease in payment to any organization from risk adjustment alone will be less than 2 percent. (These analyses were based on incomplete encounter data available prior to December 1998. Updated analyses, using complete encounter data, will be conducted in early 1999, and these analyses will be provided to organizations on March 1, 1999, for use in determining their Adjusted Community Rate proposals for CY 2000.) We will continue to monitor the impacts on organizations throughout the transition period.

5. Other implementation issues

Treatment of demonstrations: Several commenters on the *Federal Register* notice asked how the new risk adjustment methodology would apply to current demonstration projects. In particular, these commenters asked about the application of risk adjustment to several important demonstrations that provide services to special populations. These projects are the Social Health Maintenance Organization (SHMO) Demonstration, theProgram of All-Inclusive Care for the Elderly (PACE), EverCare, and the Minnesota Senior Care Project.

The Social HMO Demonstration began in 1985 and is scheduled to continue through December 31, 2000. Congress established the Social HMO Demonstration and authorized an enhanced payment methodology that exceeds traditional Medicare payment in recognition of the additional health services mandated for the project's special population. In addition, the Balanced Budget Act of 1997 (BBA) requires the Secretary to develop a plan to transition the Social HMOs to the M+C program with a recommendation for a payment approach that takes into account the risk factors appropriate to the population served.

Like the Social HMO demonstration, PACE also has an enhanced payment methodology that was mandated by Congress to reflect its special population. PACE began in 1987 and will be converted to a permanent benefit under Medicare within the next 3 years.

Although EverCare does not have the longevity of the other projects, it is a well established 5-year demonstration that is scheduled to end December 31, 2000. Under the Minnesota Senior Health Options (MSHO) Project, HCFA and the State have integrated the financing, service delivery, and administrative systems of Medicare and Medicaid to create a unique care system for dually eligible beneficiaries in

Twin Cities metropolitan area.

Because of the unique features of these demonstration projects, we are assessing possible refinements to the risk adjustment methodology. This analysis cannot be completed in time to apply any recommended refinements in the year 2000. Therefore, we have decided to delay implementation of a risk-adjusted payment system for organizations participating in these demonstrations until we have additional information. For these demonstrations, we will temporarily maintain the present payment approaches and not use the M+C risk adjustment model in year 2000.

We are working with the organizations participating in these demonstrations to acquire encounter data that are both claims and survey-based and include inpatient, outpatient, and physician data, as well as functional status information. Our objective is to evaluate risk adjustment payment options for the special populations they serve. We plan to collect data in 1998, 1999, and 2000. We are examining the possibility of using a hybrid system after the year 2000.

Reconciliation for late encounter data: Plans have approximately 3 months after the end of a data collection year to submit the encounter data that will be used to develop beneficiary risk scores to their fiscal intermediary. For example, plans must submit encounter data for the period July 1, 1998 through June 30, 1999 to their fiscal intermediary by September 17, 1999. If plans submit encounters after this date, they will not be incorporated into payments for CY 2000. However, in response to concerns expressed by plans over this short time frame, we expect to institute a reconciliation process that will take into account late data submissions. Plans should attempt to have alldata in by the deadline of September 17, 1999. However, if plans receive UB-92s from hospitals after this date, they may submit the encounter to their fiscal intermediary and the data will be processed. Plans should note that the deadline for submission of all data from a payment year will be established (probably June 30, 2000 for the period of July 1, 1998 to June 30, 1999). After that date, the fiscal intermediary will no longer accept these data. After the payment year is completed, HCFA will recalculate risk factors for individuals who have late encounters submitted. Then, we will determine any payment adjustments that are required. This reconciliation will be undertaken after the close of a payment year and will be a one-time only reconciliation for each payment year.

Additional information on the reconciliation approach will be provided to plans over the next several months.

Implementation schedule: Following are the key dates in the implementation of risk adjustment:

- *March, 1999*

  The annual announcement of payment rates will be released on March 1, 1999. This announcement must include the final county rates for CY 2000, the rescaling factor for each county, the PIP-DCG model, and other information necessary to ensure that readers are able to recalculate the final county rates.

  In addition, each organization will be sent a letter indicating the percentage difference between the organization's payment under risk adjustment and payment under the current system. The letter will also include the distribution of enrolleesfor an average month by PIP-DCG category and for other demographic factors (e.g., age, gender, Medicaid status, previously disabled, and working aged), and the distribution of PIP-DCG scores for that organization.

- *September, 1999*

  The deadline for receipt of encounter data from the period July 1, 1998 through June 30, 1999 is September 17, 1999. Encounter data received by that date will be used to calculate each enrollee's risk factor to be used in payments to organizations for CY 2000. Data received after that time will be used in a reconciliation process that will be undertaken after the close of the payment year.

- *January, 2000*

  Beginning January, 2000, on a monthly basis, the organization will be provided with information on each enrollee, including the county of residence, age, gender, Medicaid status and previously disabled status, PIP-DCG score, and payment amount.

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[2] It is important to note that, because of the blend transition policy, payments in 2000 will be based in part on the risk rate book and in part on the demographic rate book.

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D. Summary of HCFA's Proposed Approach for 2000

The approach HCFA will use to meet the year 2000 mandate for risk adjusted payments will:

(1) Be based on inpatient data;
(2) Apply individual enrollee risk scores in determining fully capitated payments;
(3) Utilize a prospective PIP-DCG risk adjuster to estimate relative beneficiary risk scores;
(4) Apply separate demographic-only factors to new Medicare enrollees for whom no diagnostic history is available;
(5) Apply a rescaling factor to address inconsistencies between demographic factors in the rate book and new risk adjusters;
(6) Use 6 month old diagnostic data to assign PIP-DCG categories (the "time shift" model, as opposed to using the most recent data and making retroactive adjustments of payment rates part way through the year);
(7) Allow for a reconciliation after the payment year to account for late submissions of encounter data;
(8) Phase-in the effects on risk adjustment, beginning with a blend of 90 percent of the demographically adjusted payment rate, and 10 percent of the risk-adjusted payment rate in the first year (CY 2000); and
(9) Implement processes to collect encounter data on additional services, and move to a full risk adjustment model as soon as is feasible.

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Table 1: Diagnoses (DxGroups) Included in Each PIP-DCG -- Payment Model

PIP-DCG 5		
DxGroup	14	Breast Cancer (b)
	131	Ongoing Pregnancy with Complications
	132	Ongoing Pregnancy with No or Minor Complications
PIP-DCG 6		
DxGroup	18	Cancer of Prostate/Testis/Male Genital Organs (b)
PIP-DCG 7		
DxGroup	1	Central Nervous System Infections
	39	Abdominal Hernia, Complicated
	64	Alcohol/Drug Dependence
PIP-DCG 8		
DxGroup	16	Cancer of Uterus/Cervix/Female Genital Organs (b)
	36	Peptic Ulcer
	77	Valvular and Rheumatic Heart Disease
	79	Hypertension, Complicated
	80	Coronary Atherosclerosis
	84	Angina Pectoris
	86	Atrial Arrhythmia
	92	Precerebral Arterial Occlusion
	96	Aortic and Other Arterial Aneurysm
	110	Asthma
	153	Brain Injury
	158	Artificial Opening of Gastrointestinal Tract Status
PIP-DCG 9		
DxGroup	21	Other Cancers (b)
	32	Pancreatitis/Other Pancreatic Disorders
	82	Acute Myocardial Infarction
	94	Transient Cerebral Ischemia
	145	Fractures of Skull and Face
	146	Pelvic Fracture
	147	Hip Fracture
	150	Internal Injuries/Traumatic Amputations/Third Degree Burns
PIP-DCG 10		
DxGroup	11	Colon Cancer (b)
	59	Schizophrenic Disorders
	81	Post-Myocardial Infarction
	83	Unstable Angina
	97	Thromboembolic Vascular Disease
	116	Kidney Infection
	143	Vertebral Fracture Without Spinal Cord Injury
PIP-DCG 11		
DxGroup	42	Gastrointestinal Obstruction/Perforation
	45	Gastrointestinal Hemorrhage
	87	Paroxysmal Ventricular Tachycardia
	109	Bacterial Pneumonia

133	Cellulitis and Bullous Skin Disorders

PIP-DCG 12

DxGroup 4	Tuberculosis
10	Stomach, Small Bowel, Other Digestive Cancer
12	Rectal Cancer
19	Cancer of Bladder, Kidney, Urinary Organs
22	Benign Brain/Nervous System Neoplasm
26	Diabetes with Acute Complications/Hypoglycemic Coma
41	Inflammatory Bowel Disease
48	Rheumatoid Arthritis and Connective Tissue Disease
49	Bone/Joint Infections/Necrosis
56	Dementia
57	Drug/Alcohol Psychoses
60	Major Depression
73	Epilepsy and Other Seizure Disorders
91	Cerebral Hemorrhage
93	Stroke
98	Peripheral Vascular Disease
111	Pulmonary Fibrosis and Bronchiectasis
113	Pleural Effusion/Pneumothorax/Empyema

PIP-DCG 14

DxGroup 2	Septicemia/Shock
29	Adrenal Gland, Metabolic Disorders
58	Delirium/Hallucinations
61	Paranoia and Other Psychoses
63	Anxiety Disorders
66	Personality Disorders
70	Degenerative Neurologic Disorders
144	Spinal Cord Injury

PIP-DCG 16

DxGroup 8	Mouth/Pharynx/Larynx/Other Respiratory Cancer
13	Lung Cancer
34	Cirrhosis, Other Liver Disorders
89	Congestive Heart Failure
95	Atherosclerosis of Major Vessel
105	Chronic Obstructive Pulmonary Disease

PIP-DCG 18

DxGroup 17	Cancer of Placenta/Ovary/Uterine Adnexa
55	Blood/Immune Disorders
72	Paralytic and Other Neurologic Disorders
75	Polyneuropathy
108	Gram-Negative/Staphylococcus Pneumonia

PIP-DCG 20

DxGroup 27	Diabetes with Chronic Complications
76	Coma and Encephalopathy
112	Aspiration Pneumonia
115	Renal Failure/Nephritis

PIP-DCG 23

DxGroup 9	Liver/Pancreas/Esophagus Cancer (b)
33	End-stage Liver Disorders
88	Cardio-Respiratory Failure and Shock
134	Decubitus and Chronic Skin Ulcers

PIP-DCG 26

DxGroup 7	Metastatic Cancer (b)

20 Brain/Nervous System Cancers (b)

PIP-DCG 29

DxGroup 3 HIV/AIDS (a)

15 Blood, Lymphatic Cancers/Neoplasms (b)

Notes:

(a) Includes principal and secondary inpatient diagnoses of HIV/AIDs.

(b) Includes principal diagnoses and secondary diagnoses when the prinicpal diagnosis is chemotherapy.

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Medicare+Choice Rates -- 45 Day Notice

Table 2: Payment Model -- Beneficiaries Medicare Eligible at Least One Year

Variable	Age/Sex Coefficient	Medicaid Add-on	Originally Disabled Add-on	Disease Add-on	
Male:0-34	1,873	639		PIPDCG 5	1,910
Male:35-44	1,939	1,442		PIPDCG 6	2,333
Male:45-54	2,486	1,888		PIPDCG 7	3,556
Male:55-59	3,134	2,025		PIPDCG 8	4,192
Male:60-64	3,874	2,134		PIPDCG 9	4,666
Male:65-69	2,759	2,244	2,115	PIPDCG 10	5,969
Male:70-74	3,598	2,330	2,029	PIPDCG 11	6,480
Male:75-79	4,625	2,353	1,705	PIPDCG 12	8,474
Male:80-84	5,495	2,271	1,462	PIPDCG 14	10,200
Male:85-89	6,414	2,060	1,207	PIPDCG 16	12,435
Male:90-94	7,019	1,688	962	PIPDCG 18	13,547
Male95+	6,923	1,235	717	PIPDCG 20	17,298
Female:0-34	1,844	981		PIPDCG 23	19,496
Female:35-44	2,055	1,590		PIPDCG 26	22,313
Female:45-54	2,685	1,870		PIPDCG 29	26,464
Female:55-59	3,280	2,025			
Female:60-64	4,544	2,103			
Female:65-69	2,310	2,207	3,083		
Female:70-74	2,998	2,246	2,940		
Female:75-79	3,810	2,314	2,645		
Female80-84	4,683	2,156	2,119		
Female85-89	5,589	1,669	1,594		
Female:90-94	5,928	1,178	1,183		
Female:95+	5,754	855	773		

Table 2: (continued) -- Payment Model -- New Beneficiaries

Variable	Coefficient	Medicaid Add-on
Male, 0-34	2,610	1,139
Male, 35-44	2,849	1,969
Male, 45-54	3,312	2,369
Male, 55-59	4,130	2,546
Male, 60-64	4,889	2,578
Male, 65	2,679	3,328
Male, 66	2,921	3,297
Male, 67	3,162	3,266
Male, 68	3,403	3,235
Male, 69	3,644	3,204
Male, 70-74	4,321	3,028
Male, 75-79	5,537	3,140
Male, 80-84	6,667	3,124
Male, 85-89	7,742	3,108
Male, 90-94	8,494	1,971
Male, 95+	8,505	1,806
Female, 0-34	2,730	1,330

Female, 34-44	2,955	2,157
Female, 45-54	3,550	2,173
Female, 55-59	4,284	2,762
Female, 60-64	5,662	2,298
Female, 65	2,276	3,076
Female, 66	2,468	3,075
Female, 67	2,660	3,074
Female, 68	2,852	3,073
Female, 69	3,044	3,072
Female, 70-74	3,587	2,945
Female, 75-79	4,587	3,030
Female, 80-84	5,664	3,003
Female, 85-89	6,771	2,162
Female, 90-94	7,290	1,670
Female, 95+	7,041	918

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APPENDIX 4

“Actuarial Review of the Health Status Risk Adjustor Methodology”

Report by the American Academy of Actuaries
Work Group

American Academy of Actuaries
Risk Adjustor Work Group

ACTUARIAL REVIEW OF THE HEALTH STATUS RISK ADJUSTOR METHODOLOGY

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The American Academy of Actuaries is the public policy organization for actuaries of all specialties within the United States. In addition to setting qualification and practice standards, a major purpose of the Academy is to act as the public information organization for the profession. The Academy is nonpartisan and assists the public policy process through the presentation of objective analysis. The Academy regularly prepares comments on proposed federal regulations, and works closely with state officials on issues related to insurance. The Academy also develops and upholds actuarial standards of conduct, qualification and practice, and the Code of Professional Conduct for all actuaries practicing in the United States.

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I. Executive Summary

This report presents the analysis by the American Academy of Actuaries' Risk Adjustor Work Group of the health status risk adjustment methodology proposed for implementation by the Health Care Financing Administration (HCFA). By law, a risk adjustment methodology must be used by HCFA for determining payments to Medicare+Choice health plans starting in the year 2000. The Risk Adjustor Work Group was formed in response to a request from HCFA for an actuarial review of their work on a risk adjustment methodology. This review is required by the Balanced Budget Act of 1997 which mandated HCFA's development of a risk adjustment payment system.

The adoption of a new risk adjustment system for Medicare reimbursements based on health status factors represents a significant change for health plans, contracting providers and health plan members. ***While the Academy Work Group believes the conceptual basis of the risk adjustment method proposed by HCFA is "actuarially sound" as defined in our report, we have serious concerns about the method's implementation, operation and impact.***

The new methodology for making health status risk adjustments to Medicare payments appears to meet the requirements of the Balanced Budget Act of 1997, provided the system is implemented carefully. On balance, and with a phase-in, the proposed risk adjustment method appears to be a reasonable first step in what should be a long-term evolutionary process. HCFA is to be commended for the progress to date and for recognizing the limitations of the proposal arising from the available data, timing requirements and areas for future improvements.

While HCFA has done much work in a short time period to develop the new methodology and design implementation strategies, additional work remains to fully define HCFA's risk adjustment method and test application of the method to make sure it achieves the intended results. The Work Group recommends that HCFA further modify the risk adjustment model with the knowledge gained during the first year of operation.

Based on our review of the information and data provided by HCFA, the Work Group has serious concerns about the actual implementation of the new payment system and its impact on the Medicare health plan market. These issues include:

- *Decisions to exclude or limit the use of certain types of diagnosis categories from the risk adjustment methodology, such as one-day hospital stays, which may penalize health plans that effectively manage the delivery of health care.*

- *Lack of adequate testing of the potential impact of the new methodology on health plans and Medicare+Choice beneficiaries.*

- *Administrative feasibility of the implementation of the new system because of timing and data collection issues.*

- *The processing of extraordinary amounts of newly collected data and completing a series of complex calculations introduces an element of uncertainty that cannot be anticipated until health plans and HCFA have full opportunity to understand the implications.*

- *Use of only fee-for-service data as the basis for the development of risk adjustment weights.*

During the review process, HCFA provided the Work Group with preliminary results of the potential payment impact of the risk adjustment methodology on Medicare+Choice plans. However, the Work Group was not able to verify the accuracy of the data collected by HCFA or the calculations used by HCFA to determine the impact on health plans. In addition, HCFA did not provide the Work Group with an assessment of the impact of the risk adjustment methodology on beneficiaries.

There is a substantial risk for the Medicare system if the risk adjustment methodology does not work as intended. The negative consequences could include withdrawal of Medicare+Choice health plans from the market, financial problems or insolvency for health plans and the potential for a reduction in benefits provided to beneficiaries. Because of these concerns, the Work Group believes HCFA's decision to implement the new methodology under a phased-in approach is a sound one and will limit changes from the current payment system while HCFA and the health plans assess the impact of the new methodology.

The Work Group was unable to fully analyze the proposed risk adjustment method due to: (1) incomplete available data and information, and (2) the continuing development of the new risk adjustment methodology by HCFA. The Work Group was not able to undertake a detailed analysis of the mathematical formulas used to develop the risk adjustment methodology, but rather focused its review on the conceptual and theoretical basis of the system. Because HCFA is still working on the proposed methodology and there are a number of unresolved implementation issues, this report is a qualified review of the actuarial soundness of the proposal. The Work Group would like the opportunity to provide further comments on the new system as it is completed.

II. Introduction

The American Academy of Actuaries (Academy) has been asked by the Health Care Financing

Administration (HCFA) to evaluate its proposed method for using the health status of Medicare beneficiaries to risk adjust Medicare payment rates. The Academy formed a Risk Adjustor Work Group (Work Group) consisting of health actuaries who are consultants to health plans and health insurers and staff actuaries for health plans or health insurers to review HCFA's proposal. This report presents the Work Group's analysis, conclusions and recommendations.

The Balanced Budget Act of 1997 (BBA) requires HCFA to incorporate health status risk adjustment in the agency's payments to Medicare+Choice health plans.[1] The law also provides that HCFA will report to Congress on its proposed method for risk adjustment. The purpose of this report is to assist HCFA in satisfying Section 1853(a)(3)(A) of the Act, which states that HCFA's Report to Congress shall include, "*an evaluation of such method by an outside, independent actuary of the actuarial soundness of the proposal.*"

HCFA plans to implement the initial health status risk adjustment method on January 1, 2000 and then replace it with a more comprehensive method at a later date. The scope of the Academy's report includes both the initial Principal Inpatient Diagnostic Cost Group (PIP-DCG) method and the possible subsequent modifications to the methodology proposed by HCFA.

The Work Group analyzed the actuarial soundness of HCFA's risk adjustment proposal in terms of (1) established actuarial goals and criteria for risk adjustment, (2) Actuarial Standards of Practice, and (3) the general principles and practices of actuarial science. Actuarial Standards of Practice are guidelines developed by the Actuarial Standards Board to help actuaries in their work. Specific actuarial goals and criteria for risk adjustment are described in the Academy's May 1993 monograph titled, "Health Risk Assessment and Health Risk Adjustment: Crucial Elements in Effective Health Care Reform" (Health Risk Adjustment Monograph).

The Academy understands that this report will be used by both Congress and HCFA and will become part of the public record. The Academy also understands the report may be provided to other interested parties. This report should only be distributed in its complete form.

III. Report Background and Methodology

A. Overview of Risk Adjustment

Health risk adjustment is a means of modifying or redistributing payments received by risk bearing entities within a health insurance system to more equitably compensate those entities for the risks they have assumed relative to one another. A major purpose of a health risk adjustment system is to make the basis of competition among carriers their administrative and medical efficiency rather than the health plans' ability to select healthy people.

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[1] Section 1853 of the Balanced Budget Act of 1997 (PL 105-33).

The risk adjustment process uses the results of health risk assessment to determine the appropriate magnitude of revenue adjustments. Health risk assessment is a method for objectively determining the relative health risks (or expected relative costs) of individuals or groups of individuals relative to an average. Risk is assigned as a simple numerical value or score reflecting the relative cost of health care resources required to meet the total health care needs of that individual or group. A key goal of the risk adjustment process is to more equitably match financial reimbursement with financial liability within an insurance system.

B. HCFA's Proposal

Currently, HCFA's published local payment rates for Medicare+Choice health plans are adjusted to reflect the risk characteristics of the plans' participants in a particular county as defined by demographic factors: age, gender, status (institutionalized or non-institutionalized, Medicaid or non-Medicaid and Working Aged). Beginning in the year 2000, HCFA is required by the Balanced Budget Act of 1997 to supplement demographic adjustments with a health status risk adjuster.

The PIP-DCG risk adjuster methodology was developed for HCFA by researchers at Health Economics Research, Inc. (HER), Boston University, and Harvard Medical School. The PIP-DCG risk adjuster will be used to assign each Medicare beneficiary a risk score based on diagnosis information from hospital inpatient stays. These risk scores, along with county of residence, age, gender, and other factors, will be used on a prospective basis to determine the Medicare payment rate for each beneficiary in a Medicare+Choice health plan.

As part of HCFA's proposed risk adjustment method, HCFA will be "rescaling" or adjusting the base payment rates. The purpose is to ensure that for each county, the new reimbursement rates utilizing health status risk adjusters should produce the same total payments for the fee-for-service populations as the current approach if every Medicare FFS member in a county were enrolled in a Medicare+Choice organization. However, implementing risk adjusters could increase or decrease total Medicare payments to health plans depending on whether Medicare+Choice organizations currently enroll a higher or lower than average share of the less healthy Medicare beneficiaries.

C. Work Group's Method of Review

The Academy was asked by HCFA to evaluate the "actuarial soundness" of its proposal. Although there is no widely recognized definition of "actuarial soundness," the Work Group analyzed HCFA's proposal according to the standards for risk assessment and risk adjustment outlined in the Academy's Health Risk Adjustment Monograph. These criteria are:

Accuracy: Since payments to health plans will be determined based on the risk adjustment mechanism, accuracy and avoidance of statistical bias is critical.

Practicality and Reasonable Cost: The risk adjustment mechanism should not be so complex that implementation is extremely cumbersome, thereby adding significant cost to the system.

Timeliness and Predictability: Carriers setting premium rates should be able to predict the impact of risk adjustment on their premiums with a fair degree of accuracy and in a timely manner, in order to avoid solvency concerns and disruption to members.

Resistance to Manipulation: The risk adjustment mechanism should aim to make it impossible for specific carriers to benefit financially by "gaming" the mechanism.

In addition, the Academy has assessed the effectiveness of the proposed methods in achieving the *goals of risk adjustment* as outlined in the Health Risk Adjustment Monograph. These goals are:

- *Reducing the effects of either inadvertent or intentional risk selection*, so carriers in a competitive market can compete on the basis of medical and administrative efficiency and the quality of service and care, rather than on the ability to select risk;

- *Compensating carriers fairly and equitably for risks they assume*;

- *Maintaining consumer choice* between multiple health plans based on rates or employee contributions that reflect relative medical and administrative efficiencies; and

- *Protecting the financial soundness of the health care system.*

The Academy's review takes into account all aspects of the proposed methodologies that impact on its "actuarial soundness," including, but not limited to:

- The proposed formulas;

- The availability, quality, and relevance of the data required; and

- The ability to be implemented as intended.

In addition, the Academy has evaluated the appropriateness of the proposed methods in relation to available alternatives (including non-administrative data models such as surveys, enhanced age/gender/status, and the status quo) and in light of the modifications being made to the underlying base rates by county over the same time period.

D. Limits of the Work Group's Analysis

In preparation for this analysis, the Academy's Work Group met with representatives of HCFA to establish the purpose and scope of the evaluation to be provided. During the meeting, HCFA staff

provided an overview of their proposed methodology that they indicated was still in draft form.[2] The agency's staff also stated they would be receptive to the Academy's suggestions for modifications to the methodology that would improve its soundness or effectiveness. Shortly before this review was finalized, HCFA also introduced three modifications to the proposal that the Work Group had reviewed. While the Work Group sees no immediate major implications of those three changes (other than as already discussed in this report), we have not had the opportunity to analyze the changes in depth.

A preliminary draft of this report was provided to HCFA for review and comment on December 8, 1998. The agency responded and submitted additional materials and data to the Work Group along with specific comments concerning some of the issues raised in the report. The Work Group considered HCFA's response and materials as it completed its work on this report.

In performing this review, the Work Group relied upon information and data provided by HCFA. This information included descriptions of the statistical methodologies summarized by Health Economics Research,[3] reports and other summary materials, answers to written inquiries submitted by the Academy,[4] and an initial version of the methodology established by HCFA during the course of this review. In addition, the Academy relied upon descriptions of the methodologies published in the Federal Register.[5]

It is important to note that the analysis and conclusions in this report are dependent on the

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[2] During the meeting with HCFA staff, the Work Group was provided with materials outlining the current Medicare payment system and the proposed PIP-DCG methodology including a technical paper titled, "Risk Adjustment for the Medicare Program: Lessons Learned from Research and Demonstrations" by Leslie M. Greenwald, PhD, Al Esposito, MS, Melvin J. Ingber, PhD and Jesse M. Levy, PhD. All of the authors are with HCFA's Office of Strategic Planning (Research and Evaluation Group).

[3] The Work Group reviewed several reports from HER: (a) Diagnostic Cost Group (DCG) and Hierarchical Coexisting Conditions (HCC) Models for Medicare Risk Adjustments (Volumes I and II, April 26, 1996); (b) Revised Diagnostic Cost Group (DCG)/Hierarchical Coexisting Conditions (HCC) Models for Medicare Risk Adjustment (February 6, 1998) and © Updated and Revised Principal Inpatient Diagnostic Cost Group Models (Draft Report, July 17, 1998).

[4] HCFA provided three submissions to the Work Group (dated October 8, 1998, November 3, 1998 and November 19, 1998) in response to requests for additional information. HCFA also submitted additional materials to the Work Group on December 14, 1998, December 21, 1998, December 29, 1998 and January 5, 1999, as part of its response to a draft copy of the report reviewed by HCFA.

[5] Federal Register, Vol. 63, No. 173 (September 8, 1998).

information supplied to the Work Group by HCFA. As of the date of this report, HCFA has not provided the final version of the PIP-DCG risk adjustment formula. In addition, only preliminary revisions of the comprehensive data methods for the risk adjustment methodology have been discussed. No formal methods have been released. **Changes in the methodology or adjustments to the data and information provided by HCFA to the Academy could dramatically impact the findings of this report.** The development of a risk adjusted payment system by HCFA is still a "work in progress" and **this report reflects a qualified opinion by the Academy on the "actuarial soundness" of HCFA's proposals based on the information available to the Work Group at the time it performed its review**. The limitations on the Work Group's analysis and findings are applied throughout the report.

In addition, the Work Group did not undertake an analysis of the specific mathematical formulas used by HCFA in the development of risk scores and was not able to determine the accuracy of HCFA's application of the risk adjustment methodology to the data collected from Medicare health plans. As a result, this report should not be considered a "peer review" of the risk adjustment formula under which the Work Group would have examined the mathematical processes used to develop the health status risk scores. The Work Group's analysis is limited to the conceptual framework of the risk adjustment methodology developed by HCFA.

IV. PIP-DCG Risk Assessment Model

A. Key Components of Model

Use of Only Inpatient Data

As previously discussed, the initial model developed by HCFA will use inpatient diagnostic data to develop a risk score for each Medicare beneficiary.[6] This information is based on hospital inpatient stays over one day for certain diagnosis groups. The risk score will be combined with revised demographic factors to develop the payment rates.

A significant component of the PIP-DCG model is the restriction of the risk adjustment method to conditions identified by inpatient hospital claims. This feature has both advantages and disadvantages. As one positive factor, this requirement matches well with the information currently available to the Medicare program. Currently, hospital claim information is more accessible and easier to audit than ambulatory care data and requires a lower amount of additional work by health plans to report to HCFA.

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[6] Individuals who are newly eligible for Medicare will be assigned a risk score based on HCFA's analysis of existing Medicare fee-for-service data. HCFA will construct a special set of risk scores for these individuals which estimates their predicted medical expenditures since they will not have any inpatient claims experience under the Medicare system.

However, there are several drawbacks to a system that uses only inpatient data. First, it is possible that a system relying on inpatient data may penalize plans which more efficiently manage health care. A major feature of managed care has been the measurable reduction in use of inpatient care, the shifting of that care to other, more cost-effective sites of service and the substitution of less invasive therapies to treat a given condition. When the risk assessment system is restricted to inpatient claims, the members enrolled in managed care can appear healthier than their actual risk level because of limits on what is measured.

A possible ramification of the PIP-DCG method is that, by using only inpatient data, the risk adjustment method is less effective than one that also includes ambulatory data because the PIP-DCG formula measures less risk (based on benchmarks such as the R-Squared statistic and predictive ratios). If ambulatory data is added to the inpatient claims information, a better picture of the potential "risk" of each individual Medicare beneficiary is obtained. The PIP-DCG methodology may result in a smaller variation in risk-adjusted payments made to Medicare+Choice health plans than would occur if a more comprehensive method were used. In the initial phases of the program this may be desirable, to the extent it causes less disruption to plans which participate in Medicare+Choice.

Principal Diagnosis

The PIP-DCG model measures conditions by capturing the principal diagnosis recorded on each inpatient claim. The use of the principal diagnosis for the PIP-DCG model is based on existing coding practices for inpatient claims used by hospitals. Since only the principal diagnosis is generally used, it is possible that not all appropriate information is collected or used. A qualifying condition could be listed as the secondary (or other) diagnosis which could be a contributing factor leading to the need for hospitalization.

For example, a hospital admission for an acute condition caused or exacerbated by hypertension or diabetes may identify that acute condition as the principal diagnosis even though it could be argued the patient would not have been hospitalized had it not been for the underlying chronic condition. There is also the possibility that restricting the data source to principal diagnosis could lead to listing a qualifying event as a "principal diagnosis" on a claim in order to receive "credit" for that more serious inpatient condition.

Alternately, there is a common belief that many secondary conditions currently reported are not as reliable and should not be included in the measurement system. Since the initial stages of the risk assessment system will be using data that was recorded without the presence of direct coding incentives, it may be reasonable to use only principal diagnosis information. However, as the PIP-DCG system is implemented, the restriction to using only principal diagnostic groups should be re-evaluated.

Number and Development of PIP-DCG Groups

Health Economics Research constructed the diagnostic groupings using HCFA's survey of Medicare FFS data (a sample of 5% of Medicare beneficiaries). The claims and eligibility information for this analysis fell in the two-year interval from January 1, 1995 through December 31, 1996. Beneficiaries who were not alive and enrolled in Medicare for the entire period from March 1, 1995 through December 31, 1995 and enrolled on January 1, 1996 were excluded from the sample. Beneficiaries were removed from the data sample if they would not have been eligible for coverage by a Medicare+Choice program for various reasons.[7]

The 5% sample is itself a bit of a misnomer. There were approximately 37.3 million Medicare beneficiaries on July 1, 1995. A 5% sample should yield around 1.9 million lives. However, after excluding beneficiaries based on length of eligibility or future managed care plan participation requirements, the sample used in setting the PIP-DCG risk adjusters is 1.4 million, which is 25% smaller. Therefore, the 5% sample is really roughly a 3.5% sample.

HER used diagnostic codes to form the diagnostic groups (DxGroups) which are used in the PIP-DCG methodology. In order to qualify for a DxGroup used in the PIP-DCG formula, there must have been at least 1,000 individuals with that diagnosis in the Medicare 5% sample. When the PIP-DCG methodology is used starting in 2000, those Medicare beneficiaries who do not fall into one of the DxGroups will be classified into a "base" group and they will be scored only on the demographic risk factors.[8]

There are questions with respect to data credibility and the design of diagnostic groups based on the HCFA 5% sample. For example, is it appropriate to use 1,000 individuals as the "cut-off" for forming DxGroups? How different would the resulting DxGroups look if the sample had been 10% of Medicare beneficiaries, or if a different 5% sample had been selected?

A second sample could be drawn to test the variability of PIP-DCGs. One possible approach would be to use a stratified sample which examines a higher percentage of beneficiaries with claims in the diagnostic categories that make up the PIP-DCG formula. While the overall number of Medicare beneficiaries in the sample might be less than 5%, the survey could sample a greater number of health plan members who fall into one of the claims categories that make up the diagnostic groups and greatly increase the effectiveness of the process. Since the goal of the sample would be to examine the cost of claims and not necessarily claim frequency, a stratified sampling would seem to be a useful tool.

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[7] For a complete description of the sampling technique, see Chapter 2 of HER's draft report, "Updated and Revised Principal Inpatient Diagnostic Cost Group Models" (July 17, 1998).

[8] The development of the diagnostic groups is discussed in Chapter 4 of the HER draft report dated July 17, 1998.

In addition, the requirement to utilize DxGroups with at least 1,000 members may be overly conservative. While this level of robustness certainly contributes to the credibility of each DxGroup, it may result in risk assessment values that are not as widely dispersed as the underlying distribution of health risk. Relaxing the restraint that DxGroups have at least 1,000 members may result in use of more DxGroups, a likely higher maximum value and a more continuous distribution of resulting risk assessment values (i.e., there would be more DxGroups with smaller increments between categories).

Because of this requirement, diagnoses could be paid at radically different levels depending upon the adequacy of the sample size when the risk adjusters are established. For example, under the current PIP-DCG modeling with no discretionary diagnosis exclusions, the highest DxGroup is formed at expenditure level 32 (approximately $32,000). There were an insufficient number of beneficiaries to form PIP-DCGs until level 23 (approximately $23,000). The information available to the Work Group did not state how many beneficiaries had PIP DxGroups at levels 24 through 31. Similarly, reversing the exclusion of PIP diagnoses with under 50 people could have the effect of restoring some bona fide conditions to the list of risk adjuster diagnoses.

The Work Group recommends that HCFA reexamine the decision to construct DxGroups using the 1,000 member cut-off once they have started collecting information from Medicare+Choice plans and have implemented the new risk adjustment payment system. The validity of this size criteria can then be based on more current inpatient data on Medicare beneficiaries.

Exclusion of "Discretionary" Conditions

The base cost group also includes Medicare beneficiaries with diagnoses that were determined by HER to be discretionary, vague, or which only occasionally resulted in inpatient admissions. This exclusion of those "discretionary" conditions has the beneficial effect of reducing potential bias in the formula against Medicare+Choice health plans with well managed care delivery systems by not giving credit for discretionary admissions and by removing the incentives to hospitalize a patient for minor illness. The diagnoses included in this restriction should be reviewed in the future as coding practices change under the PIP-DCG system. If hospitals become more aggressive in their coding in the future, the percentage of claims falling into a PIP-DCG may change and weights would need to be recalibrated, particularly if the PIP-DCG method is used beyond the currently planned three-year period.

Exclusion of 1-Day Hospitalizations

The HER report recommends excluding one-day hospitalizations from the risk assessment system to avoid giving credit for very short stays, under the assumption that including them may result in "gaming" of the system by health plans. Plans could "game" the system by ordering one-day stays for minor medical conditions in order to include beneficiaries in the health status risk adjustment process.

The prohibition against using one-day stays may result in lower risk scores being given to members in plans which efficiently manage the delivery of health care because such plans generally have shorter lengths of hospital stays. The HER report asserts that this exclusion results in only 5% of otherwise qualifying diagnoses being removed from the health status risk adjustment formula. However, this measurement was made using fee-for-service data; the impact on managed care plans may be significantly different.

HER has proposed an alternative method to excluding one-day hospitalizations which assigns varying weights to stays that are one day long versus two or more days. While this alternative does at least partially address the gaming issues, it may cause other problems. First, crediting various values to one-day hospital stays could add to the complexity of administering and understanding the system. Second, if variable DCG weights were constructed for one-day versus longer stays using fee-for-service data, these weights might not reflect the higher intensity and cost of one-day stays in a managed care plan. Third, if the same credibility and robustness requirements were applied to these hospital stays (i.e., DxGroups must contain at least 50 people), this calculation could result in more diagnoses falling into the "base" category due to insufficient people in the category and clinical judgment would be required to "reclassify" those DxGroups.

The underlying concept of excluding one-day admissions does have merit. It can reduce gaming of the system by requiring each hospitalization to be of a certain severity (measured by a length of two days or more) and plans would not have an incentive to hospitalize a patient overnight just to receive "credit," thus, the majority of PIP-DCG diagnoses are severe enough to have an average length of stay in excess of this two-day minimum. However, there are several disadvantages that should be considered.

First, according to the HER report, excluding one-day stays reduces the predictive power of the health status risk adjustment methodology.[9] If data from Medicare+Choice organizations is used, there may be more than 5% of otherwise qualifying conditions excluded from the formula. Second, this exclusion may penalize plans which more efficiently manage care, since data generally indicates that these plans have a lower average length of stay. This indicates that a plan which manages care may be paid less than a plan which does not manage care for exactly the same type of patients. Finally, it should be considered if excluding one-day hospitalizations shifts the issue of "gaming" from whether to hospitalize someone at all to a question of whether to keep the patient for an extra day. It would be appropriate to analyze the risk adjustment methodology based on whether it is easier to "game" admissions or to "game" length of stay and any resulting adverse incentives for health plans.

The Work Group suspects that the disadvantages of excluding one-day hospitalizations may outweigh any possible gain. One of HCFA's goals in designing the risk assessment

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[9] See Chapter 4 of the draft HER report dated July 17, 1998.

methodology should be to negate bias against the prudent management of health care costs by Medicare+Choice plans. HCFA may want to consider either using one-day stays as part of the risk adjustment formula or giving a partial credit or other adjustments for those hospitalizations in structuring payments to health plans.

Chemotherapy

HCFA has indicated that beneficiaries who are undergoing chemotherapy will be placed in a diagnosis category based on the patient's secondary diagnosis (most likely cancer). Since the medical conditions underlying the need for chemotherapy represent high-cost, ongoing conditions that are predictive of future medical expenses, it is appropriate that they be included in the risk assessment model. The Work Group believes including chemotherapy as part of the diagnosis groups will increase the ability of the methodology to predict future health care costs.

Demographic Factors

The health status risk adjustment methodology includes a number of demographic factors that will be used to measure the baseline predicted cost for each person. Medicare+Choice health plan members with PIP-DCG conditions will be assigned the extra cost of the diagnosis in addition to their underlying demographic costs. In general, it is not possible to "game" demographic factors such as age and gender. A brief discussion of the other demographic factors follows:

- **One Rate Book for Aged and Disabled.** While not a demographic factor per se, it is an important feature of this system because it creates a unified and self-contained methodology that includes all Medicare members (except for beneficiaries with End Stage Renal Disease, which is handled through a separate payment system).

- **Ever Disabled.** Having this add-on factor for Aged members (i.e., beneficiaries who qualify for Medicare because of their age) who were previously covered by Medicare due to disability maintains the internal consistency of the model and appears to appropriately measure the additional cost of these Aged members.

- **Medicaid.** HER indicated in its report that Medicare beneficiaries who were eligible for Medicaid one month or more during the 12-month data collection period typically had higher medical expenses in the future. Medicaid status information is generally available and does not require additional plan reporting so this coverage may be an appropriate factor to add to this model. Before implementation of the PIP-DCG system, it would be desirable to sample and verify Medicaid status, particularly in small enrollment counties where this factor could make a significant impact in the risk assessment values and the resulting payments to health plans.

- **Institutional Status.** The HER analysis indicated that available Medicare data on institutional status of beneficiaries includes two different groups, those individuals in skilled

nursing facilities, which have high current medical costs, and individuals in other types of sub-acute long term nursing home care, which generally have lower current costs. However, the HER report indicated HCFA does not collect this information on a routine basis and thus it is difficult to accurately distinguish between the two types of care using currently available Medicare data. Since institutional status information may not be uniformly collected by health plans and is subject to potential gaming, it is appropriate that it not be included as a demographic factor.

There is a concern however, that certain institutional demonstration projects (such as Programs of All-Inclusive Care for the Elderly or "PACE" and Social Health Maintenance Organizations) may have other, more expensive subgroups of institutionalized individuals; individuals who are significantly underpaid by the exclusion of this status, especially if the programs reduce the number of acute admissions which form the start of an institutional stay. HCFA should consider the development of specific health status categories for these individuals.

- **Working Aged.** At the time the draft HER report was provided to the Academy, there was an indication that HCFA was considering use of a factor for those Medicare beneficiaries who are still employed (Working Aged), since a large portion of the medical costs for those plan members may be paid by their employers. However, the use of this demographic factor must be carefully considered, since the employer who is the primary payer for medical services may not report to HCFA that a Medicare beneficiary is covered through an employer health plan.

Exclusion of Indirect Medical Education Costs

The model developed by HER excludes indirect medical education (IME) costs from the Medicare FFS data used to calculate the relative weights used in this system. The IME costs are approximately two-thirds of the total graduate medical education costs currently paid through Medicare (the FFS data does include direct medical education (DME) expenses). While it is technically incorrect to include any graduate medical education costs (since medical education costs will be paid outside of the capitation rate in the future), any distortion is likely to be small. However, it is possible there will be some internal inconsistencies in the model since high-cost conditions captured in the PIP-DCGs may more likely be treated in a tertiary care or teaching hospital.

Factors for Newly Enrolled Medicare Members

In addition to currently eligible Medicare beneficiaries (either in the FFS program or in health plans), the risk adjustment method will have "neutral" factors for new Medicare members without any diagnostic history. HCFA has decided to develop a special set of risk scores for those individuals who are eligible for Medicare for the first time and do not have any prior encounter data in the Medicare system.

HCFA has used FFS data to construct average expenditures for categories of newly eligible

members (beneficiaries who become eligible for Medicare because of age or disability or members who were previously eligible for coverage but deferred entry into the Medicare system). Newly eligible members will be assigned an estimated risk score based on HCFA's estimate of their predicted medical expenditures. The validity of these risk scores is unclear. We therefore suggest HCFA review its risk scores for the newly eligible once current data is available.

Application

In developing risk assessment scores for each person, HCFA intends to examine all fee-for-service and encounter data to produce each person's score. It is important to combine data from all sources to account for movement between plans and between the fee-for-service and managed care systems. The impact of the new system on individual Medicare+Choice contractors is unclear. HCFA has not completed substantial testing of individual contractors.

B. Predictive Power of the Model

According to HER, approximately 87% of Medicare+Choice health plan members will receive a score based on demographic factors alone. The other 13% will also be assigned a score based on their PIP-DCG diagnosis. A primary question is the extent to which the proposed health status risk adjustment methodology is useful in predicting future medical expenses and therefore is an appropriate formula for Medicare reimbursement to health plans.

Risk Assessment - A "Work in Progress"

The goal of a risk adjustment method is to match the payment to a health plan or provider with the need for health care services of members. The goal of risk assessment for the Medicare population is to appropriately pay health plans for chronically ill members. Defining the "need" for health care services is a less than exact science. Most risk assessment methods which have been developed to date have tended to share certain inherent assumptions. While these assumptions represent the best available current mechanisms for measuring health care needs, they are also generally recognized as being less than perfect.

One assumption is that the "need" for health care services can be measured by prior use of services. Some observers argue that many of the health care services which are performed today are not medically necessary. However, it must also be recognized that there is no general agreement about which services are appropriate and which services are, in fact, unnecessary. To the extent that certain disease categories have a greater or lesser number of "unnecessary" services than other disease categories, current risk assessment methods may overstate or understate the true "need" for services.

Another premise is that people with similar physical conditions will need similar amounts of

medical services. The difficulty lies in defining "similar physical conditions." No current administrative method of diagnostic coding captures all of the aspects of illness which relate to a patient's "need" for services. Even if such a method were devised, it is not currently administratively feasible to collect all of the specific details in order to completely define any given patient's medical needs. Risk assessment methods will always put some patients with varying needs for services into identical risk stratification categories. At the same time, no risk assessment mechanism should be expected to completely replicate prior costs.

Concurrent Versus Prospective Risk Assessment

Another important factor in predictive power is whether the risk assessment method is prospective or concurrent. A concurrent method matches the current year's risk factors with the current year's health care need. A prospective method uses the current year's risk factors to predict the following year's need. Predicting future costs based on current conditions will always be less accurate than predicting the costs which were incurred during the time frame when the risk assessment factors were assigned.

For a variety of reasons, however, prospective approaches for a risk assessment method are still preferred by most observers. Concurrent methods tend to compensate for the treatment of acute conditions. In addition, concurrent methods compensate for accidental conditions which are otherwise unpredictable and do not require risk adjustment. A prospective risk adjustment method, therefore, should not be rejected simply because it does not predict costs as well as a concurrent method.

HCFA has indicated it will use the prospective system in its risk adjustment methodology. This choice is likely to reduce gaming of the system by placing the emphasis on diagnoses with high ongoing costs, which are typically chronic in nature, thus reducing the emphasis on traumatic, acute conditions which may be self-limiting. The disadvantage of a prospective system is that it has significantly lower predictive power than a concurrent system. The advantage of the prospective methodology is that it provides health plans with an incentive to manage care because they stand to gain if future costs are lower than prospective payments. A prospective risk adjustment methodology also provides health plans with a greater ability to predict future payments which improves the solvency of the system.

Measures of Predictive Power

There are several measures of predictive power in general use today, including the R-Squared statistic and the Predictive Ratio. The R-Squared statistic measures the variance between the predicted use of services and the actual use of services on an individual by individual basis and compares the result to the variance for the entire population. The resulting score is expressed as a percentage of variance and the highest (i.e., most predictive) score is 100%. The best prospective risk assessment methodologies currently range in the area of 10% for individual Medicare beneficiaries. Using demographic information alone (similar to the current Medicare

AAPCC model) will usually produce an R-Squared score of about 1%. A number of researchers estimate the best possible individual score is around 20% for risk assessment systems.

The Individual R-Squared value is less useful to health plans since the nature of insurance is to spread risks of random fluctuations over larger populations. Identifying actual values for each participant is less important.

Another measure of predictive power is the "predictive ratio." This indicator measures the ratio of the actual use of services to the predicted use of services for a group of individuals. Predictive ratio scores may range from 0 to many multiples of 1. Typically, risk assessment methods for large random groups will typically generate predictive ratios very near or at 1.00. On the other hand, application of risk assessment to non-random groups consisting of all individuals with certain diagnosis categories such as diabetes or asthma can sometimes achieve scores between .85 and 1.15 if better risk adjustment methods are applied.[10] In general, predictive ratios are more meaningful than R-Squared scores to health plans, particularly if a health plan contracts with specific providers with expertise in certain high cost conditions and therefore attracts more than its share of individuals with these conditions.

Risk Adjustment - Not a Remedy for Inefficiency

If a risk adjustment method has a high degree of predictive power, it will better allocate available funds according to the underlying need. This does not mean, however, that all health plans will have similar financial results. Even if the predictive power of a risk assessment scheme is very accurate, more efficient health plans will either be more profitable or will be able to charge lower premiums than less efficient health plans.

How Much Predictive Power is Enough

One test of a risk assessment mechanism is whether a majority of health plans receive sufficient income to cover their costs on an on-going basis. A successful method will encourage health plans to continue contracting to provide Medicare coverage and to expand their marketing to higher risk beneficiaries.

For Medicare beneficiaries, a successful method will minimize disruption in the market and possibly increase the number of health plan choices available. For policy makers and financing organizations, a successful method will provide an indicator that funding is appropriate (i.e., minimizing excess profits/surplus), that enrollment is expanding, and that beneficiaries with higher risk status are not avoided.

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[10] See: "Risk Adjustment For The Medicare Program," Greenwald, et al.

C. Implications of Indefinite Use of the PIP-DCG System

The proposed PIP/DCG system is expected to be in place only for a few years at most and then replaced with an enhanced system. The Work Group believes that there are significant negative implications if the proposed PIP-DCG system is used more than a few years. One of these is that health plans which use outpatient alternatives to hospitalization would be financially penalized by a risk adjustment system that uses a formula based only on inpatient diagnostic data. Potentially, this limitation could penalize the more efficient plans enough to make them leave the Medicare market. In addition, it might create an incentive for plans to promote less efficient care modalities in order to increase Medicare payments.

In addition, the proposed system does not increase risk factors when an individual falls into two or more diagnostic groups; rather, the individual is scored only at the highest severity group. This lack of increased risk adjustment for combined conditions may unduly reduce the effectiveness of the risk adjustment system, as health plans with the most severe cases of a given DxGroup will have a greater incidence of multiple conditions.

This restriction could underpay health plans which include providers that typically treat more patients with multiple chronic conditions, provide incentives for those plans to drop those providers from their provider panels, or provide incentives for health plans to market themselves to only the most healthy potential enrollees. On the other hand, any recognition of the higher cost of these chronically ill members is an improvement over the current demographic-only method of capitation rate development.

V. Consideration of Comprehensive Data Models

The currently proposed risk adjustment methodology only uses diagnostic data from inpatient hospitalizations. HCFA has indicated that one future enhancement to the system will be to include comprehensive data, starting with ambulatory diagnostic data.

There are a number of advantages to including ambulatory data:

- Using ambulatory data can capture high risk situations even where hospitalization did not occur. Some high cost treatments, such as chemotherapy, can be performed on an outpatient basis. Even though such patients require a high level of medical services, they are not recognized as high risk by an inpatient-only system. In addition, efficient health plans which have implemented disease management processes to avoid the need for hospitalization would be treated more appropriately under a system which includes ambulatory care.

- Some risk assessment systems using ambulatory data have significantly better ability to predict risk levels. Higher predictive power means more equitable payments to health

plans.

- Even if not used for risk adjustment purposes, it would be helpful for health plans to capture this data to measure the efficiency and quality of health care delivery.

- Using only inpatient diagnoses produces a financial advantage to health plans to admit patients even if hospitalization is otherwise questionable. Public policy probably argues that health plans should not be rewarded for choosing more expensive treatment than is medically necessary.

On the other hand, there are several disadvantages:

- Complete ambulatory data is not currently captured by many health plans via an electronic mechanism. Requiring ambulatory data will require the expenditure of significant capital expenses for certain plans. This requirement will add to the overall cost of the system.

- Including ambulatory encounters will significantly increase the amount of data required from health plans. This situation increases the opportunity for error. Auditing an inpatient stay requires a relatively small expenditure relative to the cost of hospitalization. Auditing an ambulatory encounter requires an expenditure which represents a significantly larger percentage of the cost of the services provided.

- Many diagnoses are originally coded by physicians more as possibilities rather than conclusions. Hospital diagnoses are the diagnosis as of discharge, which is much more likely to reflect the best conclusion of the medical staff. Ambulatory diagnoses do not distinguish between admitting and discharge diagnoses and are, therefore, somewhat less likely to be accurate.

- Ambulatory data will need to be captured from a wide variety of sources and will likely require significantly more time to accumulate. A small fraction of the population is hospitalized in any given year, but the majority of people have some contact with the medical community. The increase in the input data to the risk assessment system would be very significant.

- There is more likelihood of inconsistent coding, because while some physician contracts may include incentives for better coding, other capitation contracts may reduce physician incentives to code thoroughly.

Including ambulatory diagnoses in the risk assessment system should increase its predictive power and therefore the equity of payments. It will reduce bias toward compensating health plans for more intensive treatment than is strictly necessary. On the other hand, including ambulatory diagnoses will increase the cost of any risk assessment system, will decrease the

timeliness of the system, and may provide more opportunity for incorrect or inconsistent coding.

In general, the advantages of including ambulatory diagnoses seem to justify their use. A more thorough cost-benefit analysis should be performed. Currently, the Work Group is unaware of any other means of risk assessment which would meet the stated goals of a risk assessment system in a more efficient manner than a proper use of ambulatory diagnostic data.

VI. Implementation Issues

One of the keys to any risk adjustment methodology is the ease or difficulty with which it is implemented by HCFA and the resulting impact on Medicare+Choice health plans and their members. The recent decision by a number of Medicare+Choice organizations to withdraw from the Medicare market underscores the need for developing a system which fits within the operational needs of managed care plans.

A. Timing of Payments

HCFA has indicated that data are likely to be collected from July 1, 1998 through June 30, 1999 for application to capitation rates effective January 1, 2000. This schedule, combined with prospective risk adjustment regression factors, will result in capitation rates that lag behind the theoretical prediction period. For example, for a person hospitalized on July 1, 1998, the regression factors predict that person's cost for the year beginning July 1, 1999. However, the capitation rates using these regression factors will not be paid until January 1, 2000. This lag between the data reporting and application, while lengthy, is significantly shorter than the lag in other systems currently used, such as the Health Insurance Plan of California or the planned implementation by the Washington State Health Care Authority. Other systems, such as Business Health Care Action Group in Minneapolis, use more frequent quarterly updates.

Another timing issue concerns the determination of year 2000 benefits. The proposed timing of risk adjustment causes some serious problems for Medicare+Choice health plans. By March 1, 1999, these carriers will only know the preliminary estimated risk scores, calculated on a market wide average basis. However, the health plans must also commit to the year 2000 premium rates and benefits by May 1, 1999 when they file the Adjusted Community Rate (ACR) proposal. Health plans can not make such commitments with any degree of certainty while their income in the year 2000 is so uncertain. As a result, carriers may take various measures to limit this risk, including reducing benefits or even leaving the program altogether.

The Work Group suggests that HCFA consider addressing this timing by giving each health plan their own member-level risk scores by March 1, 1999 or earlier, or by allowing health plans to submit rate and benefit revisions after May 1, 1999. HCFA may also consider limiting the amount by which the risk adjustment factor will be used to calculate the reimbursements.

The Work Group recognizes that some of the timing issues are based on legislative requirements set out in the BBA. To the extent that any of the changes suggested by the Work Group in this report require legislative action, HCFA may want to work with Congress to modify the existing law.

B. Recalibration of the PIP-DCG Model

As discussed, HCFA intends to start using additional data in its risk adjustment methodology within the next few years. Therefore, risk adjustments are likely to be based upon updated and more comprehensive data in the near future. However, the proposed time frame for establishing a more comprehensive risk adjustment system may be aggressive. If the PIP-DCG system is used going forward, re-measurement and recalibration of the current PIP-DCG weights should be considered.

The Balanced Budget Act of 1997 enacted several changes in provider payments. These changes are effective at different points in time, but all are effective starting after 1997. Therefore, the relative values of the diagnostic cost groupings based upon future claims will most likely differ from measurements based upon 1995 and 1996 Medicare payment rates. For example, on the fee-for service side, BBA increases payments to primary care physicians and decreases payments to surgeons. Payments to hospitals are being reduced: fiscal year 1998 hospital reimbursements are frozen at 1998 levels and capital and disproportionate share reimbursements are being reduced. Capitation payments to Medicare+Choice plans will exclude graduate medical education costs in the future; however, the direct medical education expense component of these costs are included in the claims data used to develop the risk assessment model. As previously discussed, any distortion that results from including DME may be small.

C. Examination of the Re-Scaling Factor

It is the Work Group's understanding that one of the key factors in the implementation of the PIP-DCG model is the re-scaling factor. This factor is necessary to assure that average payments for the FFS population in a county remain the same, whether the current AAPCC methods or the new PIP-DCG model is used. In other words, risk scores of health plans must be synchronized with a new measure of the average risk of Fee For Service Medicare beneficiaries in a county.

Although the re-scaling factor is not a direct part of the PIP-DCG method (re-scaling would be required with any new method), the Academy cannot determine the effects of the PIP-DCG method on health plans without understanding its implications - which means understanding how the re-scaling factor works. It is likely that health plans will feel it important that the details be disclosed prior to final implementation of the new risk adjustment methodology, so that they can fully assess the impact of the new risk adjustment system.

The credibility of the factors used in small enrollment counties and in counties with relatively few remaining fee-for-service enrollees should be considered. Since this factor is critical in the operation of any formula, it is important to understand exactly what the effect is in small counties, how sensitive the factor is to changes in base years, and what techniques HCFA will use to increase credibility or to minimize the effects of statistical fluctuations. For example, the number of Medicaid recipients in a small county may vary dramatically from year to year, especially with changes in the economy.

HCFA provided the Work Group with a general outline of how the rescaling process will work. We understand that HCFA plans to compute average risk scores for each county using three years of FFS data (1994, 1995 and 1996). However, a single year (1996) will be used in all but the smallest counties to create a restandardized rate book for determining the risk adjusted payments beginning in 2000.

The Work Group cannot adequately estimate the impact of the health status risk adjustment formula on health plans without more detailed information about the method, the calculation and the data underlying the calculations. The Work Group was unable to fully analyze the mathematical formula used to produce the rate book or how the formula would operate with the data collected from health plans. The Work Group suggests that HCFA continue to review the rescaling process and determine its overall impact on the risk adjustment payment system.

D. Phase-In of the Risk Adjustment Methodology

HCFA has indicated it will phase-in the new risk adjustment payment system rather than make the changes all at once. It is anticipated the new payment amounts based on the health status risk scores will be blended in some fashion with payments calculated under the current system. The shift to the new methodology will be made in incremental steps over the next few years.

The Work Group believes this decision to phase-in the risk adjustment methodology will help avoid significant market disruption that might otherwise occur. The potential impact on health plans from the risk adjustment formula could be significant and both HCFA and the plans need time to fully understand the changes. This phase-in approach will also provide HCFA with the opportunity to adequately test the accuracy of data collected from plans and to verify the underlying assumptions used to develop the risk adjustment formula.

VII. Recommendations

A. Sensitivity Testing

Health Economics Research performed a number of tests on the PIP-DCG risk adjuster methodology to determine how well it predicts total expected medical costs. The

recommendations made by HER regarding several key components of the model such as the use of inpatient data only, exclusion of one-day stays and the number of PIP-DCG groups to be used, appear to be reasonable based on the FFS data which was reviewed. While Health Economics Research has discussed potential bias against managed care organizations that deliver care more efficiently than fee for service providers, HER did not have managed care data to determine what, if any, bias exists.

HCFA has completed some preliminary testing of the potential impact of the new risk adjustment methodology on Medicare+Choice plans, including managed care organizations. The Work Group believes HCFA should update these tests as additional data is available from plans and the agency and health plans gain more experience with the operation of the risk adjustment mechanism.

The Work Group recommends that HCFA consider the following testing protocols to allow a more thorough analysis of its health status risk adjustor methodology:

Tests Using Managed Care Data

1. Continue to test the impact of the risk adjustment methodology on managed care organization revenue. Managed care organizations could experience significant decreases in revenue due to the implementation of the risk adjustment methodology. The results of the tests should be compared among managed care plans with several different characteristics:

    a. Medicare enrollment (large, medium or small).

    b. Total enrollment (large, medium or small).

    c. Urban versus rural service areas.

    d. Level of county payment rates (low, medium or high).

2. Test the impact of coding practices.

    a. Start with a given set of inpatient charts.

    b. Code once, within legally allowable parameters, with the goal of producing the most revenue under the risk adjustment methodology.

    c. Code again, within legally allowable parameters, with the goal of producing least revenue under the risk adjustment methodology.

    d. Compare the results from (b) and (c). Significant differences indicate that the method is subject to gaming.

3. HCFA's data testing needs to address the scenario in which a member enrolls in a new Medicare+Choice plan and the data from the enrollee's previous Medicare+Choice plan was inadequate.

4. Test the sensitivity of re-scaling to choice of underlying data.

   a. For a sample of counties, perform the re-scaling process calculations with one and more than one year of data.

   b. Test the sensitivity of re-scaling factors to the quality of Medicaid and institutionalized status fields.

5. Test the sensitivity of working aged adjustments. As the actual development and methodology for the working aged adjustments have not yet been finalized by HCFA, suggestions here are premature.

Tests on FFS Data

1. Test the calculation of PIP scores for small counties using one year and multiple years of FFS data.

2. Review the calculation of PIP scores across similar small counties.

3. Test PIP scores on counties with very large HMO market penetration.

Tests on Risk Assessment Formulas

1. Test variations due to differing combinations of statuses, when combining together the aged and disabled factors.

2. Test variations in the FFS demographic scores using multiple years of institutionalized or Medicaid status information by county.

B. Cost-Benefit Analysis

Consideration should be given to producing a cost-benefit analysis of the PIP-DCG methodology and any subsequent modifications. The proposed system is relatively new and it is likely that there will be difficulties in implementation. It would be very helpful to establish more accurate estimates of the cost of implementing the PIP-DCG methodology and any modifications (such as using ambulatory data) and to determine the benefits to be derived from these systems before final decisions as to implementation are made. The analysis should specifically include

the costs incurred by health plans due to changes to the system. To the extent there are significant additional expenses placed on plans, they may choose to drop out of the Medicare system rather than enter into new contracts or continue existing contracts using the new risk adjustment methodology.

C. Actuarial Oversight

HCFA apparently plans to conduct additional analysis of the impact of the PIP-DCG methodology on managed care plans. It is unclear what form that impact analysis will take. In addition, there is a need for continuing monitoring and testing of the system and future modifications. The Academy suggests that additional actuarial review be included as the system and subsequent changes are implemented.

D. Improving The Current Structure

Even if the use of ambulatory diagnoses is not considered as a future enhancement, the current system is cumbersome and could be improved in terms of simplicity, accuracy and predictability.

Simplicity - The current system uses rate books which are based on calculations that have been subject to various minimums, both in absolute amounts and in relative growth, and the rate book system is both cumbersome and inaccurate. One possible change to simplify the system would be to calculate directly the rate book amount for each geographic location to a value which represents the local cost for an individual with a demographic factor of 1 and a health risk assessment factor of 1.

Accuracy - The current system intends to use the 1997 local rate book values as the basis for future years' amounts. Increases to the factors are based on national increases and predetermined legislative minimums. One possible change to improve the accuracy would be to recalculate updates on an annual basis, using local data regarding cost, demographics and risk.

Predictability - The current system recalculates values annually using one full year's worth of data. One possible change to improve predictability would be to calculate amounts quarterly on either a year-to-date or a twelve-months-rolling basis, which would allow health plans to predict what future reimbursement levels will eventually result.

E. Timing of HCFA's Initial Testing and Analysis

The Work Group believes that testing should be done to assess the potential impact of risk adjustment in the market place. These concerns relate both to the potential changes created in the marketplace and to the delivery of care to beneficiaries participating in the Medicare+Choice

program.

The introduction of the proposed PIP-DCG risk adjustment mechanism into the Medicare program creates increased uncertainty and risk to Medicare+Choice plans. Testing and analysis is the only way to reduce this risk and uncertainty.

HCFA has completed significant testing based on fee-for-service data. The Work Group believes that further testing must be done if the uncertainty to health plans is to be alleviated. The testing should include two components. First is the sensitivity of the formula to changes in key assumptions. Second is determining the impact of the proposal on managed care organizations. Changes in revenue should be examined to ascertain if large dislocations will occur, which may result in unfortunate consequences to beneficiaries. A reasonable test of the proposal is whether or not a majority of health plans receive sufficient income to cover costs on an ongoing basis, without reducing benefits dramatically

Another concern is the quality and timeliness of hospital encounter data submitted by health plans, which might also be part of the testing process. The Work Group urges HCFA to complete its planned data testing, and to include a comparison of the number of submitted claims with an external standard for the expected number. Risk adjustment will be inaccurate if claims are either held back or denied due to edits, or get caught in a data processing bottleneck.

In order to understand the value of detailed testing when a risk adjustment mechanism is significantly changed, it would be instructive to select recent historical examples of significant change to the risk adjustment mechanisms in current use. The following examples come to mind:

- The use of risk adjustment in the Health Insurance Plan of California (HIPC); and

- The use of risk adjustment in managed Medicaid programs (e.g., Maryland and Oregon).

In planning for a significant change to a current risk adjustment mechanism, actuarial soundness could be analysed in a prospective manner through sufficient testing or in a retrospective manner through an actuarial oversight function (such as through a committee or an independent evaluation).

In the example of the Health Insurance Plan of California (HIPC), a one year simulation was conducted prior to the actual start of the program. The HIPC is an inpatient only model, similar to the initial proposed HCFA (PIP-DCG) approach.

In the Oregon Medicaid program, two methods were tested; the Disability Payment System and the HIPC inpatient only model. Score variations were reviewed and a method of credibility was introduced through the use of corridors on final risk adjustment scores.

In the Maryland Medicaid program, carve-outs for behavioral health, maternity, AIDS and "rare

and expensive conditions" are used. Stop-loss insurance is also provided. In addition, an article describing the process in the October 1998 *Journal of Ambulatory Care Management* noted that, "it will also be important to support adequate quantitative and qualitative evaluation including assessments of the actual accuracy of the payment system and its impact on patients and providers."

In each of the examples mentioned above, there was either extensive detailed initial testing or a follow-on actuarial oversight function (actual or implied). In several other states, implementation of a risk adjustment system without testing led to problems which required changes in the methodology.

VIII. Conclusion

A. Comparison of the PIP-DCG Method With Other Models

It is the Academy's understanding of the BBA provision that HCFA is mandated to use some form of health status based payment method starting in the year 2000. HCFA's current intention to implement the PIP-DCG model leads naturally to questions regarding the choice of the PIP-DCG model versus other available payment models.

The following are the Work Group's comments about various other types of risk adjustment models in the context of HCFA's choice of the PIP-DCG method. We recognize that there is a substantial body of research regarding various risk adjuster models and that we are providing only an actuarial perspective.

What types of models satisfy the BBA requirements?

Based on our experience, there appear to be at least three main classes of models that meet the BBA requirement for health status-based payment. These are:

- Diagnostic-based models with data gained from administrative sources (typically from claim records or encounter data files);
- Diagnostic information from clinical records, such as medical charts; and
- Survey-based health status information.

A great deal of research has been completed recently in the diagnostic/administrative class of models. PIP-DCGs fall into this category, as well as the other versions of DCGs, Ambulatory Care Groups, the Disability Payment System, the Global Risk Adjustment Method and several others. It is our understanding that any of these methods would likely satisfy the BBA requirement and most of the models have approximately the same degree of predictive power on

a prospective basis.

All of these data-intensive methods assume that reliable data from health plans will be available at little marginal cost. While the diagnostic data needed to produce risk assessment results will have many uses, gathering and transmitting that data in a fully operational implementation will likely prove to be challenging. Part of the challenge is just the management, transmission and audit of the data. A related issue is the need for some health plans to revise significantly their contracts, particularly if they are globally capitating providers for both professional and institutional services, without obtaining the requisite data under current contract terms.

A few researchers have explored the use of more detailed clinical risk adjustment models in a limited setting. While most clinicians would be likely to offer more support for this class of methods, the data-gathering cost is prohibitive. At this point in time, it is our experience as actuaries that clinical information from sources such as medical records and patient charts is nearly impossible to gather, except in the most manpower-intensive manner through actual chart audits, etc. As a result, models in this category are of great theoretical interest but of little practical help for the Medicare+Choice program.

Survey-based models have also been extensively researched. Many researchers report that surveys with sufficient response rates provide predictive power that is in the same range as the diagnostic/administrative class. The experience with self-reported surveys (e.g., the RAND SF-36) indicate that the health status information gathered by surveys is dependable and provides a good base for predicting future costs. There are, however, major drawbacks to use of surveys, particularly with the elderly. These drawbacks include:

- High cost of administering the survey;
- Possible low response rates;
- Likely difficulties that the elderly would have completing the survey by themselves;
- Possibility of gaming of survey results when payment is dependent on survey answers; and
- Concerns about privacy of health information.

Because it appears that HCFA wants to obtain health-related data on every Medicare-eligible person, surveys don't appear practical, since response rates will never be 100% (except in special cases, like the SHMO and PACE demonstrations). In addition, the cost of obtaining the data is known to be significant.

As a result, the only practical class of health-based risk adjusters, at this time, would appear to be the diagnostic/administrative models.

What models are appropriate alternatives to the PIP-DCG model?

Many observers recognize that using only inpatient data in the PIP-DCG risk adjustment model may result in a bias toward the FFS system. The potential problems with using inpatient data and limiting DCGs to hospital stays over one day have been discussed earlier in this report. As discussed, HCFA's PIP-DCG model uses only inpatient data. A number of the other risk adjustment systems that the Work Group is familiar with use either both ambulatory and inpatient data or ambulatory data only. We also note that new methods are constantly emerging, such as research into the use of prescription drug data.

From various research (including that funded by HCFA), "comprehensive data models" (i.e., those that use inpatient and ambulatory data) have superior predictive power to inpatient-only methods. The Hierarchical Condition Categories model as well as various ambulatory cost group models perform at an R-squared value of around 0.09 versus the approximately 0.06 performance of the PIP-DCG model.[11]

If feasible, a model which uses ambulatory and inpatient data is preferable. However, there are very significant current barriers to implementation of a full data model within Medicare, including:

- HCFA initially collected inpatient data and does not plan to collect ambulatory data from plans until at least October 1, 1999;

- As discussed earlier, many Medicare health plans do not capture ambulatory data for a variety of reasons. Most plans delegate data collection to their medical providers and ambulatory data is either not collected, is available only in very crude form, or is significantly under reported; and

- While there is standardization for the collection of inpatient data by hospitals, there is a great deal of variability in the coding of ambulatory claims. Even if data could be readily gathered from physician organizations, there may be considerable "noise" in the data due to the different coding practices used by medical providers.

As a result of HCFA's actions and the current state of ambulatory data available from physician organizations which contract with health plans, we believe that the PIP-DCG method is the only choice (by default) from the diagnosis/administrative class of models.

Are there other alternative payment models which may not satisfy the BBA provisions but would be an improvement over the current Medicare reimbursement system?

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[11] See: "Risk Adjustment For The Medicare Program," Greenwald, et al., pp. 10-12.

Although the BBA requires a health status based method, other methods which require less intensive methods may provide improvements over the current system. To the extent that HCFA has any experience or research involving other possible alternatives, we suggest HCFA discuss its findings with the appropriate legislative representatives and staff.

For example, it may be possible to create an "enhanced demographic model" which uses more readily available information, rather than health-status-based data. Enhancements could include a payment adjustment for new entrants into health plans (although it should be based on actual health plan experience, not on prior Medicare FFS claims) or modifying payment for health plan members who die in a payment year. Again, there are other issues that arise with these suggestions (such as possible perverse incentives which may appear to pay more to health plans which have more deaths). However, we believe that HCFA should consider all alternatives to improve the current AAPCC system, rather than be limited to only a narrow class of payment models.

Is there sufficient improvement in payment through the PIP-DCG model (or other health status based model) to justify the change from the current system?

Based on the preliminary report from the Health Economics Research firm, we understand the rationale which is the foundation of the PIP-DCG model. We have requested information from HCFA which would illustrate the changes in payment which would occur in a variety of circumstances. We were told any testing could not be completed until data from health plans was collected and processed, which has not yet occurred.

While this response is understandable, it fails to recognize that the health plans themselves will be required to submit Adjusted Community Rate "bids" to HCFA by May 1, 1999, shortly after the projected March 1, 1999 date when they receive information. Two months is not sufficient time reasonably to analyze such data and prepare corresponding bids. We therefore suggest that HCFA consider speeding up the testing and disclosure process, or that it delay implementation until the results are known to HCFA itself and other stakeholders (health plans, policy makers, beneficiaries and taxpayers).

At this point, the Academy cannot comment fully on the effectiveness of the PIP-DCG payment mechanism. There appears to be potential for the perception of significant problems by health plans, which can only be remedied by further information.

B. How Well Does the PIP-DCG Method Satisfy Risk Adjustment Goals?

The goals of risk adjustment are identified by the American Academy of Actuaries' Health Risk Adjustment Monograph and were previously outlined in Section III of this report. In addition, risk adjustment systems ought to be easily administered and should not provide perverse incentives to health plans or providers. The PIP-DCG methodology developed by HCFA can be

analyzed in relation to those criteria as follows:

Reducing the Effects of Risk Selection

Risk selection is a process used to enroll larger numbers of relatively low cost individuals and fewer relatively high cost individuals. High cost individuals are avoided because their cost may exceed premiums, while healthy individuals are sought because their costs will be less than the average.

Without risk adjusters, health plan revenue is based on average costs. To reduce the effects of risk selection, the health risk assessment mechanism must estimate the cost of the individual and adjust the health plan's compensation to at least partially reflect the expected difference in cost due to health status. If the additional compensation for high cost individuals is not high enough, a plan will lose money on the high cost individual and will still have an incentive to avoid covering him or her. If additional compensation is too high, the health plan will be overpaid for the risk and may seek out such individuals for whom payment exceeds future costs.

The PIP-DCG mechanism uses hospitalizations in a year to predict an individual's cost in the following year. Thus, incentives are created for health plans to identify individuals for which they will receive PIP-DCG based payments lower than expected costs and, in turn, avoid enrolling them. In particular, the proposed PIP-DCG risk adjustment mechanism will create incentives for health plans to avoid enrolling Medicare beneficiaries with:

- Chronic medical conditions, but no inpatient admissions in the previous year that would result in increased payments under the PIP-DCG mechanism;

- High cost admissions in the previous year that do not trigger increased payments under the PIP-DCG mechanism, but where significant follow-up health care costs are expected; or

- Medical conditions which are more likely than average to cause high costs from end-of-life hospitalizations, but no increase in payments under the PIP-DCG mechanism should the Medicare beneficiary die before the following year (this is an unavoidable consequence of a prospective system based on inpatient data).

Despite these concerns, we note that incentives exist in the present reimbursement mechanism to avoid enrolling any unhealthy Medicare beneficiaries (whose expected costs are greater than payments). While the PIP-DCG methodology will include some undesirable incentives for health plans, it does reduce some of the incentives that exist under the current payment mechanism.

The use of demographic-only factors for adjustment of new participants may allow for some incentive to select. However, since these individuals are typically healthier and since health

plans know that a member may stay with them for life, the one year lack of adjustment is likely a relatively minor incentive.

Adjustments based on last year's hospital diagnoses may result in some mismatch between health care cost and health plan compensation. The additional premium received through a prospective risk adjustment system is not for the high cost of the initial hospitalization, but rather is for the anticipated higher cost in the following year. In non-chronic cases or in cases where most of the cost is associated with the initial high-cost hospitalization, the future premium will not be adjusted for most of the high cost. In end-of-life hospitalizations, no insurer will receive the increased premium in the subsequent year. These mismatches may result in some continued incentive for selection.

Compensating Health Plans Fairly and Equitably for the Risks That They Assume

Fair and equitable compensation implies that the actual average health care cost is within a predictable range of the anticipated average health care cost. If a plan experiences average health care costs within this range for each age-gender, institutional, ever-disabled, Medicaid risk category, it is fairly compensated. If a higher or lower than average number of high-cost individuals are enrolled (due to risk maldistribution), the plan will not be fairly compensated unless the PIP-DCG adjustment accurately adjusts for the discrepancy. The Work Group has specific concerns about the treatment of short hospital stays, the accuracy of the Medicaid status indicator and the accuracy of the working aged status information.

If a health plan enrolls an unusually high number of individuals in a category with high cost hospitalizations, it may not be fairly compensated for the additional risk, since there is no additional premium adjustment in the year of hospitalization. However, the plan will be compensated in the year after hospitalization for projected ongoing costs.

For an individual the PIP-DCG accounts for 6% of the following year cost variability on an individual basis, which may not be sufficient to compensate for the additional cost due to potential selection abnormalities. For non-random groups of health plan enrollees, however, the PIP-DCG method represents a significant improvement to age and gender based payments. Predictive ratios for non-random groups are much closer to 1.0, meaning that the amount of over or underpayment is much reduced.[12]

Maintaining Consumer Choice

One of the goals of the Medicare+Choice program is to increase the choice given to seniors for their Medicare coverage. The health status risk adjusters may encourage health plans to offer more choices, without the fear of being selected against if they offer programs that may attract

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[12] See: "Risk Adjustment For The Medicare Program," Greenwald, et al., pp. 10-12.

less healthy individuals. To the extent health status risk adjusters compensated plans fairly, this may result in more choices for seniors.

It should be noted, however, that carrier participation is very sensitive to the level of funding. For example, last year over 40 Medicare+Choice health plans either withdrew entirely from the Medicare market or reduced service. These withdrawals impacted 440,000 beneficiaries who were forced to switch to another Medicare+Choice plan or a traditional FFS Medicare program.[13] A reduction in Medicare+Choice funding might also harm consumer choices by forcing a reduction in benefits. Without HCFA's risk adjustment method being more fully defined and tested, neither HCFA nor the Work Group can predict the impact of risk adjustment on consumer choice.

Protecting the Financial Soundness of the Health Care System

Financial soundness is maintained when costs do not consistently exceed income. Health plan costs primarily consist of health care expenses and administrative expenses. The proposed PIP-DCG methodology does not have a direct impact on administrative efficiency or costs, which in a poorly run health plan can threaten the financial soundness of the organization. Health status risk adjusters will help match the financial risk of a plan's health care expenses with income and thus could improve the financial soundness of the health care system.

Without additional testing, it is difficult to determine the effect of implementing the risk adjustment method on the current Medicare program. Since payment adjustments are not made in the year of initial hospitalization, there will be a lag in increasing plan premiums that could impact a small or financially challenged health plan.

In addition, many observers feel there is a positive impact or "spillover effect" on the health costs incurred by fee-for-service plans in those markets with a high degree of penetration by managed care plans. This effect is believed to result from the improved operational efficiencies of medical providers in their managed care contracts which are then transferred to their FFS patients. It is possible that if fewer Medicare+Choice plans are in the market, then there will be less of this "spillover" on Medicare fee-for-service plans.

Administrative Feasibility

Many other programs such as state small group reform programs have had barriers to using a PIP-DCG mechanism because of the lack of data and administrative difficulties. This may be less of a barrier to Medicare due to the central nature of the program that allows for data on individuals to be consolidated, even if beneficiaries change plans. The program's success will

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[13] "Quick-Fix Push May Derail Long-Term Medicare Plan," Wall Street Journal, January 5, 1999.

depend on the accuracy and completeness of the data provided across all plans. Medicare performs extensive auditing of information on payers that increases the quality of payer data. Medicare risk programs have not had as detailed reporting requirements and will have to provide data to a centralized organization so that each individual can be classified using their hospitalization diagnosis data. The advantage of the PIP-DCG mechanism is that the information needed is part of the standardized hospital record and, therefore, generally available.

Resistance to Gaming Behavior by Insurers and Minimizing Perverse Health Plan or Provider Incentives

When reimbursement is based on claim coding, there is always a chance of "gaming" behavior through "upcoding." When there is discretion concerning the diagnosis used on an admission, the code with the higher reimbursement may be likely to be selected in order to increase the reimbursement. The PIP-DCG methodology would be less susceptible to upcoding because hospital reimbursement is not directly impacted by the risk assessment score derived from the coding and the insurer is usually removed from the actual coding. This statement is less true when the provider essentially "is" the plan, such as in the case of a provider-sponsored organization or a staff-model HMO.

Since future health plan capitation is increased when there is a qualifying hospitalization, there will be an incentive to hospitalize patients rather than use outpatient settings. Once a patient has been hospitalized during a year there is no further incentive to hospitalize or to over-utilize services, since there is no further increase in future premiums.

One-day admissions were not included in the original study. If this component is chosen as a permanent part of the method and plans understand that if they routinely keep patients more than one day for a given diagnosis, this admission will be scored as part of the PIP-DCG payment methodology, there will be an incentive to increase some stays.

C. Meeting the Needs of the Medicare System

As noted in this report, the proposed risk adjustment methodology may tend to penalize health plans which efficiently manage the delivery of health care because of the use of inpatient data and the design of the DxGroups which make up the formula. As a result, HCFA probably wants to take steps to minimize this bias wherever practical, assuming the bias does not have a public policy basis. The Work Group recommends the implementation of a risk adjustment system based on more comprehensive data as soon as administratively feasible. The Work Group recognizes the critical limits on the current collection of Medicare data and strongly recommends that HCFA test both any new risk adjustment methods and the ability to collect comprehensive data prior to implementation. This testing should include an independent verification of mathematical calculations which make up the risk adjustment formula.

The Work Group also suggests that HCFA periodically audit the quality of data it is using to develop risk scores, and conduct tests to verify the accuracy of the assumptions which underlay the risk adjustment methodology, as the program operates over the next several years. It is important for HCFA to develop a mechanism which allows the agency to continually monitor how well the proposed methodology is meeting the provisions of BBA as well as the goals of a risk adjustment system as discussed in this report.

The Work Group acknowledges the time and effort that HCFA and its contractors have expended in preparing to implement health status-based risk adjustment for the Medicare+Choice program. The PIP-DCG risk adjustment method is a practical interim step towards better payment to Medicare+Choice contractors and is an improvement over the current demographic factor-based payment method (i.e., the AAPCC methodology), if implemented cautiously.

In addition, the PIP-DCG method appears to represent the only practical health status risk adjustment alternative available for implementation on January 1, 2000 as required by the Balanced Budget Act. The Work Group believes that more sophisticated payments methods are a step in the right direction to successful implementation of Medicare+Choice and its goal of better managing Medicare expenditures and providing choice for Medicare beneficiaries.

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